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MARCH 21, 1955

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NEWS DIGEST



Supersonic Super Mystere Starts Test Program

Douglas' new delta prototype Mystere D-558-2 entered the Super Mystere—passed the speed of sound in level flight on its fourth test day, made the day after its first takeoff May 1. The new French fighter is the first of a series now entering production.

at the factories of Avions Marcel Dassault. Prototype is powered by Robert Bull-Rover R A 7E Avon, rated at 9,000 lb. thrust with afterburner. B-1 production models will have the French Senelec Alfa 1050 turbojet incorporating an afterburner.

Domestic

Labors dispute between five airlines and the International Association of Machinists (IAM) was settled last week after nearly a week's negotiations. The new contract was signed by United, National, Trans World, Northwest and Capital Airlines. Eastern Air Lines, also involved in the dispute, refused to join the pact. The agreement covers about 34,000 employees until Oct. 1, 1956, and involves wage increases ranging from 5 to 7 cents an hour—or a combined total of \$1,977,000 annually.

Radically new aircraft proposals, developed to substitute and greatly reducing fuel tanks, are in production for Navy's Bureau of Ordnance at Armstrong Corp., Lancaster, Pa., developers of the weapon. Shell is hollow and carries of 100,000 rpm. In parallel hole in tank and ignites contents. Named "Clockwork Gun" by the Navy, it also will be delivered to Avon under a production contract with Henry Mottel Engineering Co.

Nuclear-powered aircraft design, still in the early stages, is being made by Curtiss-Wright Corp., Woodbridge, N. J., under a USAF contract.

Orion amphibious engine proposal, controlled by the "Verde system" and fitted by engine beneath a standard platform, have been submitted to the Navy. Dr. Ladislaus Hildebrandt, Inc., Mr. Vernon, N. Y., has made 163 flights with its D-54 Helio-Vector. An amphibious engine has submitted a second proposal.

General James, Sr., former president of Colonial Airlines, was fined \$12,000 by U.S. District Court in New York for falsifying the carrier's records while he headed it from 1938 to June 1951. Colonel, charged with carrying passengers at an inflated rate, received a suspended sentence.

F-100A, flight simulator, the first built for a supersonic aircraft, is being produced by Westinghouse Air Brake Co.'s Union Switch & Signal Division at Swanton, Pa. The simulator was designed by Sclerco, Inc., a wholly owned subsidiary.

Dr. Gen. Harold I. George has been notified to active duty as a consultant to USAF Chief of Staff Gen. Nathan F. Twining. Former Air Transport Command chief, General "Red" George "Red" George was in the Pacific until he was discharged to active duty.

Reg. Gen. Edgar E. Glanz, 35, USAF, representative of the Korean front talks, former commander of the 1st Air Reserve Center at Ames and assistant chief of staff of the 14th Air Force under Maj. Gen. Charles E. Smith, died May 10 in San Antonio, Texas.

Financial

United Aircraft Corp., East Hartford, Conn., will ask stockholders at the Apr. 26 meeting to approve an increase in common shares from 4.5 million to 7.5 million, each with a par value of \$5. UAC also will propose authorization of 500,000 shares at a par value of \$100.

such. The new issues would provide flexible capital structure and obtain funds for adoption of UAC's present 5% cumulative preferred stock.

United Air Lines reports net earnings of \$9,617,694 for 1954, a 6% gain over the previous year's \$9,072,382 and second only to 1953's record \$10,651,820. Operating revenues totaled \$20,719,306, bringing \$200 million for the first time and closing 1955 down 1953. Operating expenses were \$178,811,242, also 16% higher than last year.

Trans-Canada Air Lines had a net income of \$495,146 in 1954, its fourth straight year of profitable operation. Net for 1953 was \$258,230. Operating revenues totaled \$68,764,272, compared with \$67,246,561 the previous year. Operating expenses amounted to \$67,767,512, increasing from \$64,453,780.

International

British Overseas Airways Ltd. had a net income between London and Johannesburg last week, following the week set by a de Havilland Comet 1. The four-engine jetliner made the 4,070-mile flight in 15 hr. 52 min with one stop. Although 121 jet Comet's shorter range forced it to make several stops and cut time to 21 hr. 50 min. The V1, 190 will start flight tests in Africa under tropical conditions.

Sugg Sales, Ltd., has been formed in Britain by Sugg Aircraft Co. and W.D. Sugg & Co., Ltd., to market the U.S. firm's 50-hp. Moss turbine.



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600	600	600	600	600
700	700	700	700	700
800	800	800	800	800
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GRUMMAN SIZ-1 subsonic turbojet shows its distinctive gear in operation. A Vibration Detector beam extends from the fuselage and a Grumman vibration detector, with three shrouds to reduce turbulence, is under fuselage. Vibration detector and fuselage are interconnected, the subsonic and turbojet turbine. Sometimes are ejected from the engine nacelles.

New Hunters, Transport

MARTIN XP-101B SEAMASTER subsonic jet fighters recently made its debut at Baltimore, Md., to prove the superiority of the subsonic engine equipped high-speed fighter. Wings of the big jet fighter have been subjected to applied loads of about 310,000 lb. First flight of the new plane is scheduled for this spring.



LOCKHEED C-130A HERCULES transport production line at Martin Co., rolled out its first transport March 20. Photo is first view of C-130A in the plant. Hercules is a USAF medium transport powered by four T56 turboprops.



INDUSTRY OBSERVER

►Northrop Aircraft's next model in the Scorpion series—the F-89B—is the first, manuevering in three versions to become operational with the Air Force. R-2 effectiveness has been improved substantially through the addition of the Hughes F-89B airframe (AW Feb. 23, p. 11). In effect, the F-89B is an F-89D with ramjet capability. The B model is undergoing flight tests at Edwards AFB, Calif., in addition to the D model with the B model and which is undergoing flight tests there. Plans are scheduled to be on the first assembly line about mid-April. One of the ships is a D being converted into a B. Plans are being considered to increase the power of the B by switching to an afterburner version of another production jet engine. This version of the plane now is in the status of a proposal to the Air Force.

►Poland-Midwest lightweight fighters has completed 65 hr. of flight testing with 14 pilots. It is being fitted with a wing having fold-down sections similar to those of the Ghost for increased flight testing in April. First Ghost is due to fly with the Bristol Orpheus engine this summer.

►Cordier's company of Plexiglas and similar materials can now be made shatterproof through a Goodyear Aircraft Corp. development. Shatterproof property is obtained by stretching the material 100% in all directions, at the same time reducing thickness to one-fourth of the original dimensions. Failure-free samples of Plex 51 have been made by this process. Tests on General Aircraft's Cadet have revealed the ballistics stage that the present aircraft compares are made shatterproof through use of shatterproof construction as in automobile safety glass. New Goodyear development permits use of a single piece of Plexiglas, needs no shatterproof films.

►Douglas-developed Skyd-500, low temperature version of synthetic fire-resistant commercial hydraulic fluid, probably will fly first in British Rotaxman for British Overseas Airways Corp. British carrier probably will carry over the application to the DC-7s it is scheduled to get. Fluid was developed about a year and half ago at the recommendation of USAF, and was found satisfactory but never used.

►Future versions planned for Lockheed F-104 include modifications for replacement trainers as well as all-weather versions with capability of carrying two-stage cruise.

►Second production British Rotaxman turboprop transport has made its first flight and passed the prototype and first production model in an intensive flight development program.

►Buffeting set up by the big retractable belly refuse as the Grumman S-1F subsonic transport has been eliminated by installing fixed ribs on the midspan to break up the surface (see picture, p. 9). Goodyear Aircraft Corp. makes the skin-plate surface.

►Douglas F-4D-1 Skyre, Navy interceptor, is scheduled to begin its carrier trials in about a month. Aircraft first flew in January, 1961, now it is powered by a Pratt & Whitney Aircraft JT-57-2 engine.

►Soviet is developing a medium-thrust turbojet, smaller than the Alt-5. Static tests of its new engine were made a few months ago.

►Military elements have been informed with the slacking job done by General with the help of an engineering group from Massachusetts Institute of Technology on a modified version of the Convair 340 transport. Among other features the new Model 340 has a square nacelle. It will gross 1,800 lbs. more than current version and add 15 mph to cruising speed in addition to the slanting features. CAA certification tests are scheduled for June.

►General Dynamics of General Dynamics Corp. has organized its first division to explore industrial applications of nuclear power and its F-16. Worth aircraft plant. The new atomic facility is separate from the work now being done at Ft. Worth on a nuclear-powered aircraft.

WHO'S WHERE

In the Front Office

Dr. Harold R. Smith, vice president of Boeing Aircraft Co., has been appointed an independent consultant member of Boeing's Air Engineering Board.

Robert Van Rensselaer, president of Boeing Company, has been named president of Boeing Aircraft Co., New York, replacing Robert C. Smith, who resigned.

Robert W. Smith, who moved up to president of Wyman-Gordon Co., Worcester, Mass., succeeding Harry C. Smith, new chairman of the board.

F. J. Mahoney has been elected vice president and general manager of American Airlines de Mexico, wholly owned subsidiary of American Airlines. The recently George C. Van Nostrand, who has become vice president-proprietor and community officer of the parent company.

Harold R. Smith, vice president of Boeing Aircraft Co., New York, has taken over the firm's Eastern and Western Division as general manager.

Changes

Walter H. Smith, designer and builder of the first U. S. heavy bomber and president of the parent Boeing Aircraft, Inc., has moved from General in superintendent of inspection at the Ft. Worth plant.

Ray W. Smith has been appointed general manager of General Electric Co. a small aircraft engine department at Lynn, Mass.

Donald G. Rens, former senior project engineer for General Aircraft Corp. Products Division, has joined CDC General Services, Inc., Heliopolis, Pa., as general manager of the new American Division.

Raymond C. Rensselaer, chief engineer of Chance Vought Aircraft, Inc., has assumed responsibility for the Dallas company's engineering operations.

Paul W. Moore, chief of Air Materiel Command's technical staff at Wright-Patterson AFB during the Korean war, has become general counsel for Pacific Aerospace Corp., Redwood, Calif.

Paul Y. Drenth has joined General Electric, Ltd., Malton, Ontario, as sales manager.

Max E. Black has been appointed vice manager of Royal Aircraft Corp., Montreal, subsidiary of Keesey & Thayer Corp. & 34 Dora, former chief production engineer for A. V. Roe Canada, Ltd., has joined Macmillan Aircraft Co.'s Princeton Division, Van Nuys, Calif., as chief engine-propulsion.

Honors and Elections

Dr. Louis G. Dene, associate director of Research Aircraft Corp.'s General Motors Division, has won an Army Certificate of Appreciation for development work including "conversion of a research and results into the Douglas model aircraft system."

Carl G. Tait, manager of General Electric's Flight Test Center at Schenectady, N. Y., has been named industrial committee chairman of the National Business Aircraft Assn.



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ADVANCED ELECTRONICS FOR CONTROL

Washington Roundup

ARDC Shift to Dayton?

USAF Secretary Harold T. Pratt is making an secret of his preference to move ARDC headquarters from its present quarters in downtown Baltimore, Md., to Wright Patterson AFB at Dayton, Ohio, near Air Materiel Command headquarters. Special USAF committee is now studying relocation of ARDC headquarters, with Cambridge, Mass., and Andrews AFB, Md., (where ARDC was originally scheduled to move) also under consideration. Pentagon insiders are letting that T. Pratt's choice of Dayton will prevail. Observers who have followed the long and bitter ARDC-AMC battle before the T. Pratt's expressed more to Dayton could easily be the first step in substantiating the search and development effort to ARDC control.

Federal Airport Program

Congressional consideration of the \$11-million fiscal 1956 federal airport aid program is expected to involve the following major points:

- **Size of the program.** The \$11 million program is only a token program, actually will accomplish little, since a single year's support for the Washington area would require \$25 million more. Congressional action is expected to increase the size of the program since it involves local spending.
- **Two-year authorization.** Local authorities concerned with rising matching funds to augment federal aid are asked over the period two-year basis of the program and want it to shift to two-year authorization similar to that used for public works programming.
- **Inclusion of terminal buildings.** Present program excludes aid of federal funds for terminal buildings and confines it to runway, lighting, etc. Congressional feeling is that terminal buildings are legitimate part of airport operations and should be included in federal aid.
- **Scope of program.** There will be considerable discussion as to whether the present standards for matching grants in program are adequate to meet modern needs.

Lower Military Mail Rates?

Civil Aeronautics Board is strongly considering lower mail rates for international mail shipments of military mail than for civil mail. They are the same for military mail and cargo in very large shipments and are not unusual in the high-density routes so that the cost of performing the service is reasonably low. Irving Roth, chief of CAA's Rates Division, explained to the House Appropriations Committee.

Pentagon Changes

New lines continue to join the Pentagon's central structure, while the main chain continues to be developed outside its three pillars. Expected exits of Defense Secretary Charles E. Wilson and Army Secretary Robert Stevens have not developed and Wilson still insists there is no ground for the rumors.

Meanwhile, Robert T. Ross, former Navy Secretary of Defense, has been named as Assistant Secretary of Defense for Legislative and Public Affairs, replacing Fred A. Benson, who has been named to the White House to give his command in more important circles. Ross is spoken of as a top-ranking possibility to become

new chairman of the Republican National Committee.

At a lower level and of more impact to the system, was the appointment of James D. Forster, former assistant secretary in charge of industrial relations for Pan American World Airways, as director of the new Industrial Personnel Security Review Program of the Department of Defense. An attorney, Forster will be in charge of the new central screening program set up by Wilson to speed clearance and reduce the number of cases forced into hearing.

Defense Cataloging

Completion of Defense Department's stalled cataloging task of items bought by the armed forces is in sight. The task has been under way since 1945, will include 4,000,000 items listed by the services to about 2,500,000. Examples: 360 types of screw drivers were cut to less than 150, 8,000 types of radio and electronic tubes were reduced to a standard 792.

Navigation Aid Snarl

Despite over military Tacon or civil VOR/DME in the common civil military system for short range navigation has been clouded by confusion about the DME in instrument and overstatements of inflated Tacon costs (See p. 77).

Total cost of VOR/DME may approach \$50 million but more than 50% of that amount represents civil military investment in VOR instrument equipment which will be used for another 10 years. The balance was expended on VOR ground installations, except for approx. \$12 million spent by GAA for 215 DME ground units and private purchases of 88 airborne DMEs.

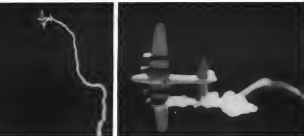
ANCO's decision to push development of Tacon for eventual adoption as the common system with a 10-year phase-out of VOR was intended to get full value from VOR. The immediate transfer of distance information by getting DME in aircraft was considered by ANCO. The cheapest path to pay in order to get the common system back on the track.

Carrier: Low Vulnerability?

Opposition to carrier status has been presented "outside the Department of Defense" and "has been expressed on without the aid, assistance, or support of the military departments concerned," House Armed Services Committee declares. Its report this points out:

- A carrier task force which can be spread over an area of 51,000 sq. mi., approximately the size of Indiana, "obviously" does not present a profitable target to an enemy, regardless of the type of bomb he may be using. This is further emphasized by the fact that the task force is always moving and thereby can avoid serious effects of threatening weapons.
- In the troubled waters around Formosa where "our fleet activities are... limited," the importance of having our carrier force move into the thousands of miles to maintain national policy "was readily apparent to all."
- Although Formosa has already lost 1,000 aircraft, "there is no indication concerning their loss in 'building' carrier." "We should continue to exploit this weakness at the Soviet Navy by continued development of our own aircraft carrier force," the report states.

—Washington Staff



FAUCON TRACKS, strikes down Boeing B-17s in demonstration of its effectiveness as the USAF's newest air-to-air missile.

Operational Missiles Now Arming USAF

Scientific achievements spur program of Atlas ICBM; Falcon proves successful as a defensive weapon.

By Robert Hiss

Guided missile program of the U. S. Air Force has reached a successful development stage and is making progress toward the production of operational missiles for both offensive and defensive use as a result of major scientific achievements by the aircraft industry and its research support.

These developments are:

- **Package atomic and hydrogen war heads.** Development of small, light-weight atomic warheads with high destructive yields equivalent to early bulky bombs has been a major problem for the missile builders. Now smaller warheads in the weight and size of hydrogen weapons promise to simplify both guidance and propulsion problems for intercontinental missiles.

For every pound of weight reduction in the missile warhead approximately 300 lb. of fuel can be saved on an intercontinental missile. The use of a hydrogen warhead with its subsonic point of destruction also relaxes the rocket recovery requirements for precise missile guidance to the target.

- **Reentry problem.** Although details of this most necessary missile needed by military security the most difficult

part of this problem for intercontinental missiles has been recognized and growing solutions are in sight. The problem was that the ballistic missile on reentering the earth's atmosphere at hypersonic speeds generates sufficient heat from skin friction to melt the warhead. Even Gemini V-2s traveling at only 3,000 mph., encountered this problem during World War II.

- **Guidance.** Major developments in external guidance equipment have made this method feasible for long-range guidance of intercontinental missiles.
- **Powerplant.** Recent progress in both rocket and ramjet powerplants now make it possible to drive large missiles at the hypersonic speeds required for long-range operations.

Finishing USAF missile projects include:

Atlas

The Atlas SM-65 intercontinental ballistic missile (AWM 7, p. 12) is now well under way as one of the most important development programs now tackled by USAF and the missile industry. Its goal is to explode a hydrogen bomb warhead on enemy targets 3,000 mi. from the launching point.

Atlas will benefit enormously from the recent significant reduction in the size and weight of hydrogen bomb packages. Such in gross weight of perhaps more than half the original 500,000 lb. planned should be possible.

Atlas will be propelled by two sets of liquid-fueled rocket motors in a two-stage operation. One set of motors and fuel tanks will be detached from the missile after providing the power to blast out of the atmosphere into space, leaving the second set of motors to propel the warhead and guidance system to the burn-out point from which the outgoing warhead is to pick altitude targets.

Targeting calculations for a 3,000 mi. ICBM missile show a required speed at burnout of about 22,000 ft. per sec. Burning time would be about 12 min., during which the rocket would climb out of the atmosphere and turn to an angle of about 26 deg. with the horizon. It would then coast to a peak altitude near 300 mi. before plunging, tail down at first, toward the target. Total flight time would be about half an hour.

Generally the Atlas program involves the following contractors:

- **Contract Division of General Dynamics Corp.** General has been involved in ballistic missile research for eight years and was originally scheduled to be the prime weapons system contractor for Atlas. Now it appears that Convair will make the Atlas shell, fuel

tanks and possibly the warhead as well.

- **North American Aviation Inc.** This firm will make the 123,000 lb. thrust liquid-fueled rocket that will be used in the first stage of Atlas propulsion.

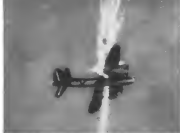
North American was also build the second stage rocket motor, but Bell Aircraft Corp. and Aerojet-General Corp. are also competitors for this position job.

- **General Electric Co.** Guidance system for the Atlas will be developed and built by GE.
- **Ramo-Wooldridge.** This firm currently has a \$5 million contract for evaluating major technical proposals in the Atlas program but also will probably get the contract to design and build the nose section which is critical to the problem of reentering the atmosphere on the way to the target.

Ramo-Wooldridge was also being considered as overall manager of the Atlas project under the weapons system concept under supervision of Air Research and Development Command's Western Development Division.

Convair's position in the Atlas program will be strengthened by the addition of Dr. Prof. de Haffmann, senior physicist and former deputy to Dr. Edward Teller at Los Alamos Scientific Atomic Laboratory and appointment of a scientific advisory group headed with other weapons experts.

• **USAF California.** Convair's engineering effort on the Atlas project has been strongly criticized by USAF for lack of sufficient talent vested in missile weapons, liquid-fueled rockets, high-speed physics and missile guidance problems. This criticism played an important role in determining Convair's original role as prime weapons system contractor for Atlas to one of several major contractors in the program. It also resulted in USAF bringing the



DEAD CENTER! Falcon strikes up through Boeing B-47 down for dead hit.

Ramo-Wooldridge group into the Atlas project.

Among the top names on the USAF advisory group are:

- **Dr. Theodor von Karman,** pioneer in supersonic aerodynamics.
- **Dr. Hans Bethe,** atomic and hydrogen bomb pioneer.

- **Dr. Edward Teller,** hydrogen bomb expert and associate director of the University of California Radiation and Lawrence Laboratories.

One big struggle to meet progress in the Atlas program has been a practical solution to the reentry problem when the missile comes plunging back into the earth's atmosphere at speeds that produce heat from skin friction sufficient to melt the toughest materials. Although the precise method of Atlas reentry is currently still clouded

by military secrecy, there are several possible known approaches to the problem. They are:

- **Shockwave.** By controlling the speed of the missile the skin friction is reduced tremendously. For example, a speed of 500 ft. per sec. will not skin heating by 75%. One method considered to slow the missile is to break it up into several chunks on reentry and allow the fragments to heat down separately. With a hydrogen warhead, the reentry heat by this operation would not be across. Mechanical speed breakers could also be used, similar to fire sleds on an aircraft air drag chutes. These devices could heat up or melt during the descent but would still slow the missile to acceptable speeds.

- **Reentry.** This method calls for utilizing expensive layers of heat-resistant materials that will burn through during reentry but keep the hydrogen-powered skin heat away from the warhead until it is destroyed.

- **High altitude explosion.** This method would explode the warhead above the atmosphere before the missile made its reentry. With a hydrogen warhead this might be effective.

Falcon

First official details on the Hughes Aircraft Falcon (GAM-88) air-to-air missile were released by David Gooden, USAF Assistant Secretary for Research and Development in a speech to the USAF Institute of Technology at Dayton. Gooden said the Falcon was "one of the most significant developments in the defense of the North American continent since the development of radar." He revealed that the Falcon is in production at Hughes Aircraft's Tucson,



HUNDRED-POUNDER Falcon in its hot bag, can be handled easily by two technicians.

Navy Blames Engine Builders For Costly Production Delays

Overoptimism of engine manufacturers who misapprehend the time needed for development of new jet power units is blamed by U.S. Navy officials and unavailably high costs in its early program.

In a hard-hitting speech, James H. Smith Jr., Assistant Secretary of the Navy for Air, told a propulsion meeting of the Institute of Defense Resources at Cleveland, Ohio, that the industry too often is guilty of using the "impossibly optimistic plan" to sell an engine proposal.

Example of Delays.—Time estimates given to the Navy, Smith said, commonly do not allow for delays in development with the two-engine aircraft that aircraft scheduling is upset at a high cost in delays and lost effectiveness.

As a concrete example, Smith told the case of the Chance Vought F7U and McDonnell F4H aircraft development of last fall. These were attributed by the Navy to the delays in the Westinghouse J40 and J46 and Allison J71 engine programs.

Smith and the Navy has an investment of over \$1 billion in these programs, not counting government-financed equipment.

Violent Resemblances.—"We underestimated the developmental time for one half and established our production schedules accordingly. Our schedule would have been just about right if the engines had required only the estimated three years in development but when they actually took more than that the cost of our program had to go through violent readjustments," he said.

One outcome of the Navy's experience has been a statement by Defense Secretary Charles E. Wilson that there have been too many engine development failures following that path. Defense Department's first suggestion for a remedy was a proposal that more standardization be introduced and fewer engines carried through to production.

Producers of the plan, which has brought strong objections from most of the industry and is known to lack teeth in both the Navy and Air Force, was the office of Frank E. Nichols, Assistant Secretary of Defense for Acquisition Engineering. It was specifically written by Floyd T. Hoyle, director of research and contract cost under the act.

Caution Delays.—Both Nichols and Hoyle are former vice presidents of Westinghouse. The former heads a committee set up by Wilson to draft a

new directive governing engine development. Smith is a member of the group, along with Regis Lewis, Assistant Secretary of the Air Force for Materials.

None of the Defense Department critics, including Smith, Nichols and Wilson, have made any mention of the role played by Navy's Bureau of Aeronautics in engine procurement. Some industry observers, opponent of Becht's responsibility to monitor development programs, have left for a long time that its experts are prone to accept exaggerated claims by certain manufacturers, turning down some conservative but realistic proposals.

So far, Becht has been silent in the growing controversy over the jet engine situation.

Further details of the F7U Carlin program were outlined last week in Chance Vought's annual report. The F7U-1 version was the company's main production project in 1956.

Further details of the program, the report says, "The Carlin program has been hampered by delays and development problems of the engines which in engine manufacturers is focusing for these engines." The newer jet is the Westinghouse J40 WRE, rated at 4,000 lb thrust.

Problems in 1955.—"During the year 1955 it became apparent that the task of introducing a conventional engine with its own engine and aircraft construction was not a simple task. The Carlin program has been hampered by delays and development problems of the engines which in engine manufacturers is focusing for these engines." The newer jet is the Westinghouse J40 WRE, rated at 4,000 lb thrust.

"It is expected that the Carlin and

its engines will be subject to development problems throughout part of the year 1957," the report says, indicating that more time will be needed to smooth out the conventional engine's production program.

On the subject of the cancellation, the report says they resulted in loss of orders for 40 Model A20-1 aircraft, the other version of the Carlin. **Openness Barriers.**—"The development and supply," the report states, "by an engine manufacturer of a new and improved engine model required for the Model A20-1 engine was completely late and therefore the Navy found it necessary to cancel the engine program. No reliable alternate engine was available."

"The production program was originally scheduled for delivery during the years 1955 and 1956, and the level of operations for those years will be reduced somewhat by the cancellation." (The reference here was to another Westinghouse engine, a later version of the J40.)

Smith pulled no punches in laying out the indictment of the country's aircraft industry.

Tougher Policies.—"It seems to me," he said, "both the engine and aircraft construction were involved with the short range view that a big contract in hand on which delivery is steady is better than the slower of a really sound program at a later date."

"In present work, let's get a big contract backing now and muddle through the production program later."

Smith said it was the Navy's procurement policy in getting together on the matter, and a significant element in the delivery what is presented comes more weight than it has in the past.

"Industry shenanigans with the government," Secretary Smith asserted, "a responsibility for the overall safety of the country."

Robotic Planning.—"In carrying that responsibility it means to slow a more realistic and sustained attitude in planning and designing new aircraft models if we are to achieve results."

"The serious work will come in the form of realistic planning and in the making of long-range programs based on objectives on which the industry and the government are at stake, not on a headlong race to build up the backlog, come what may."

"In the engine and aircraft development contracts, particularly in the case of test plan a fixed fee, the contractor is concerned, but not financially sound as his mission," the Secretary charged.

He then suggested that an industry closer to the contract might help to stress more contractors than producing what they cannot deliver.



PIASECKI H-21 tests non-overlapping patterns during Navy tests of new tug technique developed by the helicopter's manufacturer.

Navy Will Sweep Mines with Helicopters

Application of the helicopter as an aerial tug to sweep enemy minefields was disclosed last week by the U.S. Navy and Piasecki Helicopter Corp.

The new technique, for which Piasecki claims its tandem design has many advantages, partially eliminates the inherent threat of having the lead mine-sweeping vessel blow up in close-in a harbor for entrance of transport and cargo vessels.

Florida Tests.—In practice, the helicopter is used to precede conventional mine-sweeping ships, clearing the path for the first vessel of a V-shaped formation.

Piasecki's contract for development of a towing technique goes back, thus far, to the company's experience here with the Navy and the experimental station at Panama City, Fla., for post-trail tests in the Gulf of Mexico since November 1952.

Initial results were the venerable HRP-1 tandem, same model used by the company as early work on anti-submarine warfare with the fatigue stripped to increase its load-carrying ability. For mine-sweeping, Piasecki developed a speed two to four knots.

First runs with the HRP-1 proved that the helicopter could operate as fast as conventional minesweepers and as soon to reach that ships could not do the job.

Advantages.—Further towing experiments in 1953, using the newer Piasecki H-21 Wack Horse, a more powerful helicopter, demonstrated these advantages.

The H-21 could pull double sweep gear at four or faster than a mine-sweeping vessel.

Mine-sweeping of the copter is restricted area was superior to that of the mine-sweep.

Ability to operate from landing platforms on surface ships increases the



TOWING ATTITUDE OF H-21 mine sweeper is one down to get maximum pulling power.



RESCUE OPERATIONS also are demonstrated by H-21, shown here towing Navy F4 Phantom.

ability of mine-sweeping fleets.

The helicopter can produce a towing pull equal to several times its natural lift capacity, firing in a sharp meekness attitude.

The towing cable provides additional stability, making the pilot's job easier than in normal operations.

Both Piasecki and the Navy project development of the towing technique with mine-sweeping in the present version will lead to other applications. These include:

As a tug to tow double search, of

ability to both the Navy and the Coast Guard.

To free bogged land vehicles, such as tanks stuck in the sand on a landing beach, and, sweeps or sinks, a use that can be adapted to Marine operations.

According to the company, the HRP-1 powered by a 600 hp engine, exerted a pull of 5,000 to 6,000 lb in tests pulling a steel tank from the sand. Navy did not release figures on the pull exerted by the H-21, but it carries an 1193 hp engine in the version used at Panama City.

Army Creates Aviation Division

By Claude White

U. S. Army in the last two months quickly brought about three changes in administrative control over its fast growing aviation operations. All aim at Army's taking over complete responsibility for its aviation programs. They are:

- Creation of a new Aviation Division in the Office of the Assistant Chief of Staff (Operations-G-3).
- Shift of Maj. Gen. James M. Gavin, chief of G-3 and an aggressive proponent of aviation activity, to a new job as Deputy Chief of Staff for plans and research.

Redesignation of the Army's aviation school at Camp Rucker, Va. It now is known as the Army Aviation Center.

Before its elevation, Army aviation was a branch in the Quartermaster and Training Division of G-1. Top office was Col. Warren R. Williams, Jr., who now has a new assignment, Brig. Gen. Harland H. Hovine.

• Royal Growth—The change transfers Army aviation from the jurisdiction of Brig. Gen. L. V. Hughes, chief of operations and training, and puts it on a level with his divisions and two other, operations and plans.

Army explanation of the new setup is that growth of its aviation activity, limited a few years ago to a single office after formation of an independent U. S. Air Force, has arrived at the point where steps must be taken to insure proper direction and control.

Gen. Gavin's appointment to succeed Lt. Gen. Louis L. Leonard as Deputy Chief of Staff for Plans and Research follows in only two months a change that saw all Army research and development work placed under the supervision of that office (AW Jan 18, p. 14).

• Logical Step—There was speculation at the time that placing full responsibility for R&D in Leonard's office was a possible prelude to assumption by the Army of more responsibility over its research development and production activities. Staff of Gen. Gavin to this job is a logical step in this expansion of Army control.

Widely known as a veteran airborne officer, Gavin is a strong backer of the airplane and helicopter as modern vehicles to move troops and supplies to the battle line. His is the principal figure in pushing Army's program to equip more than 30 helicopter transport companies in the next five years.

There are strong indications that the Army feels R&D may be the most important field for activity to make its aviation program a reality.



BRIG. GEN. HOWZE

Three facts strengthen this view:

- General dissatisfaction with the present procedure under which Army aviation R&D projects are reviewed by the Air Force, along with procurement of aircraft.

• Equal dissatisfaction with the fact that Army must buy "off-the-shelf" equipment whenever possible, which may have no specific needs to take account of in development of new aircraft.

- Division necessity for accelerated R&D programs to approve present air-crafting equipment and speed the advent of faster and bigger aircraft, probably from among proposed conventional configurations.

"The division will have three critical elements:

- Responsibilities—The new division will perform all duties assigned to G-3 in 1952 when the old aviation branch was created. These include:

- Preparation of the Army aviation program for each fiscal year, with estimates dropped to "make accurate fully responsive to the needs of the Army."

- Coordination and representation, including contacts with the Air Force and Navy where necessary.

- Cooperation in personnel, training, intelligence and logistics to help staff agencies solve problems in these fields.

- Control of army aircraft.
- G-3 representation on boards, committees and panels where required.

- Member organizations, maintenance and employment of aviation by the Army in the field and under circumstances where necessary.

- Possible activities is aviation that will increase the mobility and combat effectiveness of the Army.
- Executive Officer—Col. Hovine, head of the new division, is a 46-year-old grad-

uate of West Point and veteran officer of the cavalry, intelligence and armored branches of the service. His assignment before moving to the Pentagon last month was deputy chief of staff for plans of the 7th Army in Europe.

Plans for major growth of Camp Rucker was indicated several months ago when the aviation school was moved there from Ft. Sill, Okla. A former tank repair base, Camp Rucker's facilities are being adapted for aviation work, and to house the board responsible for testing new aircraft.

Lobbying Costs AIA \$18,616 During 1954

Aircraft Industries Assn. listed expenditures of \$18,616 during 1954 in connection with legislative activities in its report filed under the 1946 lobbying act.

John Fluegel, former Assistant Secretary of the Navy for Air, made a new registration as representative of the Committee of Local Service Airlines at its annual convention of \$28,000.

Other expenditures reported for 1954 included:

• Harry Goodrich, De Witt Runyon and Harold Mauer filed individual reports as representatives of AIA. Mauer listed an expenditure of \$2,475. Runyon and Runyon listed no expenditures. Arnes Mellett, in representative of IBE & Keweenaw, Inc., reported no expenditures.

• Edward Rodgers and S. C. Tipton filed as representatives of Air Transport Assn. Rodgers reported an expenditure of \$3,813. Tipton \$125.

• John C. Gales, representative of Pan American World Airways, reported no expenditures.

• Larry Glavin, in representative of Air Line Pilots Assn., reported an expenditure of \$120.

• Warren Wickham, representative of Associated Training Service, reported an expenditure of \$14.95.

Douglas Sells 109 Airliners in 60 Days

Douglas Aircraft Co. sold 109 DC-6 and DC-7 transports to 17 airlines during the first two months of 1955. Combined value of the sales totaled more than \$180 million.

The orders increased the company's two-year production backlog for transport aircraft by more than 20% valued at \$350 million, largest in Douglas history. They meet orders of DC-6 and DC-7 types including military versions, to \$149.

75 transports ordered by Airway and Tobacco were 49 DC-6s and 26 DC-7s, including 34 long-range DC-7Cs.

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- Underwater Propulsion Devices
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RAF Shows Off Hunter Units, Hoping To Silence Critics

(McDermott World News)

London—Royal Air Force pilots displayed in three squadrons equipped with Hunter fighters in an effort to convince British press critics of their military aircraft development and production agencies that their supersonic fighters actually are going into service with combat units.

Two of the three squadrons are equipped with the Hunter Mark II, powered by an Armstrong Siddeley Sapphire turbojet, while the other has Hunter Mark I, powered by the Rolls-Royce Avon turbojet. Each squadron delivers about 7,500 lb. strike thrust with an afterburner. Later versions of the Hunter are scheduled to be powered by TR500-15 thrust versions of the Avon and Sapphire.

One Gas Turbine—Canards, Hunter engines are outperforming trouble when the last 18 sec. After engines are fired at altitude (Aviation Week Feb. 14, p. 7). Can gas turbine engines are lethal enough engine vibration and fragments. Avon-powered Hunters are more seriously affected by the problem than those using the Sapphire.

All Hunters will be involved with carriage link collectors to catch the aerial links as the Avon engines' ammunition belts in flight. Expected links now show up from fuselage speed brakes, even when it is returned. The link collectors will require several linkages on the under side of the fuselage. Shell casing are now ejected down and to the rear through ejectors to clear the aircraft.

• Pilot Demonstrations—RAF sources at the public display said the Hunter is able

to level flight but can get up over Mach 1 in 10 sec. It has a powered-control system with a gas-turbine and an overdriven cockpit. The pilot is protected by armor plate at his back and a bullet-resistant glass panel in the canopy. Martin Baker ejection seat is installed.

The Hunter carries its internal fuel in fuselage and wing tanks and normally has been fitted with two expendable plastic external tanks.

The Hunter fighter is equipped with automatic gas-jetting radar, which is not fitted with the cockpit. Radar is enclosed in a laminated plastic nose radome. Radar operates with a gas-jetting, not provides automatic target range information. It also can be controlled manually by a test gun on the pilot's throttle lever.

• New Gas Pack—RAF ground crew

demonstrated methods of replacing the detachable pack containing the Avon engines (Aviation Week Oct. 4, 1964, p. 11) and refueling that enabled them to leave a Hunter fully rearmored for combat in seven minutes. In doing so, the new pack, the Avon engines are removed complete with landing, ammunition, clamping and breach and new guns installed. The pack, complete with gas and fuel instrumentation, cost, weight 3,000 lb. Each Avon engine can fire 1,200 rounds per minute.

In an alert and scramble demonstration, 11 Hunters were on the line with pilots in cockpits. Using catapult launchers simultaneously, the first Hunter got rolling in 1 sec. 99 sec. with the rest following at 15-sec. intervals. Down Hunters got off the line in 1 sec. 35 sec. One failed to start due to mechanical failure. In 6 sec. 11 sec. of 12 Hunters were back up at the end of the runway for takeoff.

Aviation demonstration had 12 stop short engines at the end of the runway and the scramble to takeoff. Using catapult launchers they were all ready for takeoff within 1 sec. 20 sec. and the first Hunter was off the ground in 1 sec. 5 sec. after the scramble order. All 12 were in the air within 1 min. 20 sec.

NACA Construction Wins House Approval

The House passed legislation authorizing an \$5.45 million construction program by National Advisory Committee for Aeronautics, after several amendments passed the agency.

Authorization for \$5.45 million for construction of a nuclear reactor at the Lewis Flight Propulsion Laboratory in Lewisville, Texas, was included in the project in Atomic Energy Commission's nuclear program.

NACA's request for \$13.5 million to finance the construction program in the House, before the House Appropriations Committee in the 1955 fiscal year budget.

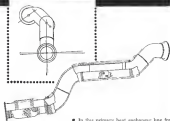
Details of the work planned are: • Lewis Flight Propulsion Laboratory, \$5,395,000. Construction of an experimental system for the 16-ft. transonic tunnel will extend its speed range to include Mach 1.2, and provide for testing of large-scale models to determine characteristics of aircraft that become critical in the low supersonic range.

• Ames Aeronautical Laboratory, \$1,055,000. A high speed, free-flight facility will provide for investigations into the transonic heat generated by viscous boundary layer. • Langley, \$1,000,000. A steel pipe firing test chamber and instrumentation will permit investigation of engine heating and stability at speeds from 2,000 to 6,000 mph. • Lewis Laboratory, \$5,910,000. Con-

USAF Rating

Mr. H. N. Evans, USAF pilot who commanded one of the three RAF Hunter squadrons on an exchange assignment, rates the British fighter as better than both the North American F-86 Sabre and the Russian MIG-15 fighters, but believes it is inferior to the F-100 Super Sabre now being put into squadron service in USAF. The Sabre and MIG-15 have been operational since 1956 and had two years combat against each other in Korea while Hunter development was lagging in Britain.

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version of the full 1/2" tunnel will permit accurate operation. Two test cells are planned for research on high-energy fuels for rockets and turbopumps.

Prize for NACA included these restrictions on the Home floor.

Rep. Cliff Edwards: "I have always been impressed with the attitude of the people at NACA. They have lost one thing in mind: How to build better airplanes than any other country in the world."

"I have no doubt that many of the scientists and other personnel of the NACA could benefit themselves greatly from a financial standpoint by leaving the NACA and going with aircraft manufacturers and private research groups."

Lockheed Prop Device Cuts Cabin Noise 25%

Fullerton, Calif.—Lockheed Aircraft Corp. has announced a new propeller synchronizing system designed to make noise level 15% quieter.

The combination electrical and hydraulic system was developed by Lockheed flight test engineers to reduce noise in the passenger cabins of transport aircraft.

■ **Millisecond Accuracy**—The device, referred to as a "synchronizing" system, keeps propeller blades in step with an accuracy of a millionth of a second, according to G. L. Johnson, chief engineer of Lockheed's California Division. Flight tests have indicated that the exact reduction in sound level varies throughout the cabin but averages approximately 25%.

"Synchronizing actually cuts sound two ways," Johnson said. It reduces sound volume by 30 decibels and smooths and even the remaining sound to make it more acceptable to the ear."

Working with Lockheed on the system were the Hamilton Standard Propeller Division of United Aircraft Corp. and the Curtiss Propeller Division of Curtiss-Wright Corp.

■ **\$10,000 per Plane**—No online order later, Bendix received for production the system, Lockheed reported. But the device may become standard equipment on future Lockheed transports.

No announcement of the cost for installation in present aircraft was made by the Fullerton firm, but such a system possibly could be installed for less than \$10,000 per aircraft.

Weight of the total system is estimated at 65 lb.

■ **Specified Relationship**—Synchronizing, Johnson explained, is a matter of controlling the propellers to have at a specified relation to each other and at precisely the same advance angle to the fuselage. Variation from propeller tip to hub are reduced 75%.

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at the points where these forces strike the propeller lobes.

To keep the propeller blades in phase, an electronic governor is used. The governor takes its cues from magnets mounted on the square of each propeller and from coils on each engine nacelle. When the magnet passes the end of the coil, an electrical impulse. The impulse then generates thrust electrically to the governor, which compares the timing of impulses from each nacelle.

If these impulses differ by more than one-thirtieth of a second, the difference is corrected. Corrections are by electrically actuated propellers a made through an electrical connection from the electronic governor to the flyweight governor of the propeller. This brings the offset propeller into phase with its mate.

The electronic propeller, the master in the dance of each engine, retards the propellers.

Atlantic Air Freight Agreement Approved

Operation of Aersand's North Atlantic cargo service by Slick Airways and Transocean Air Lines has been approved by the Civil Aeronautics Board.

Slick and Transocean will now weekly airfreight service between New York and London under terms of the foreign air carrier permit issued Aersand April 1, 1955. Aersand has an order for DC-6A freighters, but delivery won't be made until early 1956, and Aersand wants to get into operation before that.

Agreement Terms—Under the terms of the approved agreement, Slick will operate regularly weekly roundtrip flights with DC-6A equipment between New York and London and New York and Shannon, Ireland. Slick will pay operating and maintenance costs, carry maximum insurance and handle all flight issues. Under these conditions, Slick will be paid \$150 per aircraft flight hour.

Transocean will also operate weekly

Sabena Expands

Sabena flight sales, unit wants will extend its helicopter network with a new route between Brussels, Luxembourg, Dusseldorf and Bonn.

Sabena has purchased two more Sikorski S-55s at the last step in its growing helicopter service to several other West European cities.

The Belgium airline has ordered 100 feet of door helicopters close service started in August 1955.



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flights from New York to either London or Shannon, using DC-6. The American company will pay all operating and maintenance costs, carry insurance and furnish flight crews. Trips of payment will for \$10,000 for New York-London roundtrip flights, \$5,500 per New York-Shannon roundtrips and \$100 for London-Frankfurt roundtrips—about \$300 per flight hour.

Aerovis will pay landing fees, load cargo and take care of customs clearance. Refs. agreement terminate with the conclusion of the last flight scheduled during the week ending May 3, 1956, subject to extension by Aerovis. **Chertoff Deal**—In the agreement with Shik, Aerovis has the option of using its own flight crews and paying flight operating expenses. On flights where Aerovis handles its own crews, Shik will get \$125 per flight hour. Shik is interested in breaking its own personnel as in the DC-6s prior to delivery of its own aircraft.

As long as Shik operates the flights, CAB considers the deal a charter flight, not a lease. If Aerovis should decide to use its own crews, the agreement would become a leasing proposition and CAB approval would be necessary.

CAB has also authorized Aerovis to



XF6M Design Details

First official show-off drawing of Globe's Martin Co. new XF6M-1 SeaMaster comes up the engineering paper-covered flying boat's unusual design. Of particular interest are the long-length narrow beam hull, fixed plastic wing-mounted floats, swept T-tail and mounting of four Allison J19 turboprop ship wings. Hatch on top of the SeaMaster's hull permits loading of cargo and other weapons, carried on a rotating beach-berth to the hull bottom.

add Manchester as a co-terminal with Portsmouth and London and to add Birmingham as an intermediate port.

**CAB to Ease Foreign
Aircraft Certification**

Proposed changes in Civil Air Regulations to permit type certificates for foreign aircraft and related products under basis of reciprocal agreements with countries manufacturing the planes and certifying them have been issued by Civil Aeronautics Board.

U. S. now has nine bilateral agreements in effect providing for reciprocal recognition of certificates of airworthiness for imported aircraft.

Foreign Reciprocity—Certification of aircraft under the bilateral agreements has caused difficulties, CAB says, because these agreements provide only for recognition and not type certification. The Civil Aeronautics Act requires a type certificate as a prerequisite to an airworthiness certificate.

The bilateral agreements were all concluded prior to the Civil Aeronautics Act of 1938 and had little practical effect until recently, during a resurgence of civil aircraft design and manufacturing—particularly in Europe. This resulted in requests for U. S. certification of foreign manufactured aircraft.

A new part of 10 of CAB, would permit the Civil Aeronautics Administration to issue certificates and approvals if the country with which the U. S. has a bilateral certificate that it meets CAB standards for aircraft built in the U. S. The new rule also would require that technical data be furnished by the foreign manufacturer if requested.

Aircraft and related products which because anticipated would be designated as "import" and listed as such.

**House, Senate Bill
Subcommittee Posts**

Rep. Tom Stoen, Oklahoma Democrat, is the new head of House Small Business Committee's Subcommittee on the Aircraft Industry.

Other subcommittee and their directors are: Regulatory Agencies, Rep. Joe Ewing; Small Business Administration, Procurement, and Loans, Rep. Abraham M. Miller; Materials and Metals, Rep. Sidney Yates; Distribution Programs, Rep. James Roosevelt.

Senate Small Business Subcommittee includes Monroney, Russell Long, Military Procurement, Sen. George Smith; Relations of Business with Government, Sen. Edward Tamm.

Sen. John Sparkman and Rep. Wright Patman head the full Small Business Committee of the Senate and House, respectively.



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newest, least understood super alloys. Through close integration between laboratory and factory, this knowledge becomes a basic part of aircraft production know-how.

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AERONAUTICAL ENGINEERING Scientist Shortage Threatens Defense

By Henry Lefler

The gap between America's need and America's supply of trained technical-scientific manpower is large, and growing larger. There is hope that it will be closed in the next few years. But in the meantime, says a leading research group, "We're sitting on a time bomb."

Donald A. Quarles, Assistant Secretary of Defense is particularly a greater threat to national security than are any weapons known to be in the arsenal of aggressive nations.

It is an axiom of defense planning that the United States and its allies cannot hope to match the Moscow-Peking axis man for man. Russia and China between them, not counting the other satellite nations, have a population of more than 750 million. The cold war, in the words of Quarles, "is a technological race with the Communist world."

Looking the Race—How are we doing in the race? Not too well.

At the present time, the U.S. has about 500,000 engineers and 200,000 scientists, Russia has 600,000 and 150,000. But as our guiding star shows that 20,000 engineers a year, a figure that is expected to rise to about 27,000 in 1976, a peak of 34,000 in 1977, and then decline.

Contrast this with Russia. From a 1952 engineering graduate roll of about 30,000, the rate has risen steadily and is expected to reach 45,000 in 1976.

Add to this picture the figures for technicians—the men who maintain the complex equipment on which our security is based and who must now highly trained engineers and scientists in their jobs.

Russia maintains 1,700 technical (technical training schools) whose past enrollment is about 1.6 million the device, machine of official Bureau forecasts indicates. In the U.S. there are about 1,000 two-year technical schools with a total enrollment of 78,000. These figures do not include technical institutions maintained by USAF, which are extensive. But there is no reason to believe that Red Air Force efforts in this direction are less intensive.

At Russia's Lead—Look at our Air Force manpower situation. Airman entering the service at an annual rate of 60% at the end of their first four-year tour. Even if they can be replaced presently in service, the long process of training goes from into skilled mechanics and technicians must begin again.

Every time a skilled man leaves the Air Force, it costs our country a little

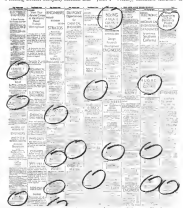
flight after 110,000 engineering man-hours. It took the same company 1,340,000 engineering man-hours to bring a new jet to first flight. Another company reports an investment of 1 million engineering man-hours for development of a new bomber.

These figures refer to specific aircraft projects, but typify the increasing technological base of our society. While our population is doubling every 15 years, need for skilled workers is doubling every 20 years and the requirements are highly trained scientists even 10. Right now, engineers and scientists make up only 0.5% of our total population.

Why Study—But scientific vocations apparently do not have a strong enough appeal for our young people. Our system is economic. It takes an average of 17 years for an engineer to pick up basically with his brother who went directly from high school to a job at, let's say, an electronic technician, says John F. Vickers, executive secretary of

Engineers & Scientists

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1971 to 1974. Compare this with the need for new science teachers of 7,700 in 1974.

Another danger to our technological leadership is the growing stress on general studies in high school, with consequent neglect of mathematics and the sciences.

To our attack on the copper-aluminum shortage must be made at the high school level. Privilege and pay of teachers must be increased. Teachers must be given an opportunity to keep up with their specialties. Some companies are making a contribution here by providing summer employment for high school teachers.

It is suggested that industry and professional groups cooperate in arranging plant visits for school groups and in other ways keep them interested and informed.

• **Exposed to Draft**—A common complaint of researchers and schools is the lack of a discount policy on the drafting of students against all technical and scientific careers. Exemption from military service for any group is a politically touchy subject.

Most military service plans contemplate that every young man in the appropriate age bracket will have a taste of the military life. In actuality this does not work out, since our military manpower requirements are not large enough to include all in the eligible pool.

So actual drafting when it is the "wheel of the lead draft board," causes inevitable confusion.

• **The Graduate Years**—A very high percentage of important basic discoveries are made by men in their study berths, scientists point out. Even if a man returns to science after his military service, they say, we have lost most of his most creative years.

The scientist's viewpoint is made clear by Dr. R. A. Mischke, executive director of the Scientific Manpower Commission. Every man should get in some time in government service for the nation's military protection, he believes. But this does not necessarily mean military service. Consideration should be made of the person's special ability and he should be assigned to the service which makes the most use of his abilities and training.

• **Kid Tape Trouble**—Regardless of the relevance of any program for the needs of our supply of technical people, we will have to live with the facts of the shortage for some years. It is vital, therefore, that we make the best and most efficient use of the limited supply we have.

One way of doing this is to eliminate the old tape traffic that clogs the operation of our universities, especially in government. The National Aluminum Commission for Associations, which con-

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plus about 7,000 of other items can find an assembled and research scientist and design and business experience, has been studying studies in this direction. The burden of red tape and administrative details has been nearly completely removed from their shoulders, forcing them to do what they were hired to do—research, says Robert J. Locklin, NACA personnel officer.

This not only helps make better use of scientists, it helps to keep them. One of the major objections of those trained people to government service is the tedium of paper work involved. "Power administration and 'box administration'" is a common plea.

►NACA Study—A study conducted among personnel of NACA's Ames and Langley labs by the Interdepartmental Committee on Scientific Research and Development uncovered a number of approaches for making government service attractive.

Among the favorable factors were freedom from pressure to divert full time for contractual purposes, opportunity for fundamental research in large, well-equipped labs, opportunity for publication of findings, contact with top scientists in and out of government.

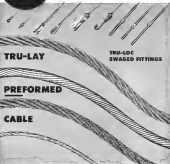
Complaints were registered about red tape, lack of privacy, limitations in getting research financing, indifference, fluctuating support on the part of those controlling the purse strings, loss of prestige of government service as a result of antitrust investigations, and the widespread undercurrent of opposition and suspicion throughout the nation directed against "efficiency" and "conductivity."

►Pay and Advancement—There were pleas for fair pay (as compared with industry), maintenance of interest benefits, opportunities for adequate professional recognition and growth, a policy of advancement for scientists working to scientists. Too often, the only way a scientist can advance to top levels is by taking on administrative tasks.

NACA has noted and expects to get permission to raise the pay of its lower grades, to get them within striking distance of the pay offered by industry for responsible work. A good deal of the money research of better public relations—getting the story across to the street and to the public in general.

►Scientific Research—Scientists in government feel their prestige would increase if they could type out the wide spread feeling that one nation's research establishments are herds of addies. They ask for a more visible and growing approach to the scientific problem. "The real security of the United States depends on progress," says Fred John R. Dunning, dean of engineering at Columbia University. Specifically, scientists ask for freedom

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from industry and wharfed interpretations of security regulations. They point to the case of the Republic Aviation Corp. engineer who was dismissed last year as a "security risk" because he had a "psychoanalytic background" that made him too unstable for secret work. On appeal, it was discovered that some over-stress reactions had misread or misinterpreted a variation on his record that he had been discharged from the Navy with 30% disability for nervousness caused by intense flying of aerobics (jungle rot, a tropical skin disease).

The story has a large ending. The Eastern Industrial Personnel Security Board's appeals division reinstated him.

► **Prize Important**—There is a curious justice in the security situation after Sen. Joseph McCarthy had charged that one of our nation's research efforts was harboring a large number of disloyal employees, applications for jobs went up sharply. Some citizens for this in with the garage angle—everybody wanted to be able to say he worked for the government on very important, back-bush work.

It might be a worthwhile undertaking for educational foundations to sponsor a whole series of new awards and honors in recognition of scientific achievement.

All of these things provide clues as to approaches which could increase the supply of technicians for government.

► **Engineers in Industry**—Obviously, as any fair competition for technical manpower, industry will get the lion's share. This is because of higher pay scales, greater opportunities for advancement, the chance to see one's ideas translated into practical reality fairly early.

There are 75,000 engineers employed in the private industry—out of over 11 million. The number will rise. The competition between employers for engineers and scientists is intense, although usually it is already known upon. So is the competition between industry and government. The struggle will continue as long as the supply is short. Only if the various programs underway and contemplated succeed will the basic situation be relieved.

Meanwhile, industry must close its doors. Many complaints are heard from engineers that they are not being used to the limit of their skills. They are tied up on low-grade tasks and administrative detail which could be handled by others without this specialized training and skills.

We should follow the Russians in extensive employment of women.

Air Force

The Air Force is faced with an extremely severe manpower situation. This is not to make use of pilots and



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often and success of long service. The danger is among the groups whose first four-year lotch ends now and in the next few years.

This group includes the hundreds of thousands who enlisted in USAF in the period following the Korean war; when the Air Force goal rose from 48 weeks to 7½, to 95, 135 and 165, and tapered off to the present figure of 137 weeks, to be reached in 1957.

► End of the hitch—“These men have satisfied their obligation under the law; they have completed their contract with the Air Force. . . . There is no compelling reason for them to remain in the service,” says Brig. Gen. R. H. Carlschlag, Air Force Director for Personnel Procurement and Training (Acquisition and Recruiting).

Service made by the Air Force shows that about 90% of these men plan not to reenlist, about 10-15% signify the intention of staying in the service, and the remainder are undecided. Of those with more than four years of service, close to 70% say they plan to reenlist.

Air Force estimates that in the fiscal years 1955-1957, close to three-quarters of a million airmen will be separated from the service for various reasons. According to present intentions, about 150,000 will resign and 180,000 are considered nonrenewable (retired, demoted or discharged, failure to reenlist). This leaves more than 400,000 male airmen whom Air Force would like to hold on to.

The loss in dollars represented by this 400,000 man group has been put at \$5 billion, if we accept the estimate that it costs an average of nearly \$15,000 to train an airmen to the level of skill represented by four years' service and attendance at various USAF schools.

► Half-Tinhead—More ironic is the consideration that this group together with the nonrenewable add up to more than half of the claimed USAF level of 975,000. Pondering the situation through all major commands, one can envisage a Strategic Air Command, for instance, more than half of whose personnel is considered not fully trained. And, Air Force says, at this age of jet it is quality, rather than quantity which counts.

Air Force takes the trouble and expense to train to various specialties, advance men here confident to help to skilled levels. At the end of his first four-year enlistment, he is considered skilled or even super-skilled.

The dream of this maniac is a flying Penthouse; pleasant view a gleaming night. Ideally, an appeal to the man's patriotism should do the trick. Lt. Gen. Ernest O'Donnell, Jr., Deputy Chief of Staff/Personnel, points out. However, this appeal appears to be far-fetched, and Air Force has set its face

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Douglas B-66 takes off for test run. Defense includes G-E constant speed drive in plane above.

B-66 is first tactical bomber with radar controlled defensive armament system

The US Air Force's latest test platform, the Douglas B-66 will be the first tactical bomber equipped with General Electric's MD-1 fire control system. Test flown in June last year, the B-66 is capable of carrying atomic bombs.

Like other G-E designed and produced defensive armament systems currently in operation, the new B-66 system is one point of control equipment, and a tail turret mounting two guns.

PROVIDES AUTOMATIC PROTECTION
A similar system now installed on the B-47, operates as follows in performing these functions as a "preloaded" tail defense:

- Automatically warns the gunner as an incoming radar target or approaching aircraft.

- Automatically tracks and positions the guns on selected target by means of radar.
- Continuously supplies windward, ballistics and lead corrections by means of an electric computing network.
- Fires guns electrically under control of the gunner.

HOW SYSTEM OPERATES

Briefly, here's how the system operates: When the B-47 enters a danger area, the gunner switches the radar to "search" and adjusts the system control panel to provide the computer with air temperature, altitude and air speed information.

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Radar then supplies the computer with the position and range of the attacking plane. Necessary gun deflection and corrections are computed automatically. When the leading aircraft enters gun range, the gunner presses a trigger which fires the guns electrically.

If you would like more information on the MD-1 fire control system and are charged to receive classified data, contact your nearest G-E Apparatus Sales representative.



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tion a number of long-term, passive programs aimed at "training" the people whom we can retain and returning the people whom we lose."

► **Quantity Surveys**—One phase of the attack on the resettlement program is a series of quarterly surveys on women's resettlement intentions. These normally reach 5% of the total women population in each group. From them, planners have been able to determine the factors that appear to make Air Force life attractive or unattractive, and they then open up fields for exploration to make the resettlement percentage go up.

An interesting point the surveys have brought to light is that those with more education are less likely to enlist, and those who are married or have dependent children are more likely to do so. The surveys also find that women from the southeast and southwest sections of the country are more likely to enlist.

However, "it is doubtful if the new power pool will ever be large enough in that increased training can be offered. For example, only in Arizona will an refugee, who are recruited and from rural backgrounds" as Air Force staff with reports.

► **A Step Up**—One factor point the surveys have uncovered. The answer is that to recruit men there for whom the Air Force represents a step up, both socially and economically. The recruitment of this for USAF planners is that the Air Force ought to be made a step for a greater percentage of the population.

This would suggest more pay, better housing, greater prestige among civilians to make a few approaches.

A good deal of Air Force's manpower problems is directly tied to its own funds. It calls for public and congressional awareness of the situation and the need. There is a great need to establish the Air Force—and the other military services—as a way of life (person's) early in an individual's life. This would appear to be a long-term educational project working into every home and school.

However, there are a number of factors USAF itself is taking which could have only just.

► **Relief Search**—A Resettlement Search has been set up. This is the combined Air Staff organization to deal with the problem. Under its wing, there has been set up a Package Program for Resettlement, which deals with the various factors that operate on the morale of the stress, and are considered largely unimportant in whether he stays in the service or goes. The package suggests resettlement procedures and presents plans that are in effect at various command and base.

Field Management teams have been set up, which will have visited all 149 Zone of the Interior bases by the end

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of the month and will then start a tour of USAF's overseas establishments.

There are groups gathering data, comparing studies, making analysis, using public information media to help in the task of "retaining the trust."

■ **NCO Paygrade Improvement:** Air Force recognizes that it is operating now in a "bazaar's market," and it has taken strong steps to reduce or remove the cause of many airman gripes, as they have come to light in its various surveys.

One major action is its Noncommissioned Officer Paygrade Improvement Program. "We hope to make the NCO pay system fair and improve the NCO's pay," says Gen. Cunningham. But the lower income grades are not neglected, for it is hoped to increase the prestige of the NCO in general so that all young airmen will aspire to attain that status and thus become successful.

As part of this program, NCOs now have the responsibility for many jobs which formerly fell to officers. NCO assignments and "pay schools" have been set up. At Santa Rosa, Alaska, Canada, (camped) of NCOs, have been set up, which must periodically forward recommendations to the base commander in various occupational problems and activities.

In one step concerned, promotion reports prepared by major NCOs with regard to personnel under their supervision are considered by a promotion board of five senior NCOs as such squadrons. Recommendations of the promotion boards are generally followed by the base commander.

Other prestige-enhancement actions include elimination of manual details,

the privilege of check-outing on the base without an officer's endorsement, establishment of company messes, clubs, and sleeping quarters, no restriction on travel distance during off-duty hours, ensuring of two-personity rights to surviving personnel, as available.

■ **Power of the Woman:** The woman's vote fits in the remodeling picture, too, and Air Force is making every effort to see that she is an USAF's role.

Assurance is offered no change of status, including consideration held at the new status, coming temporary bases are arranged to the can shop with her husband, provide "open house" is held at various stations to show her the importance of her husband's job, and the opportunity is provided for community life and social gatherings at most bases. There are NCO Women Councils and NCO Women Clubs, which sponsor base exercises and child care centers, among their other activities.

Air Force's concern with its personnel's family problems extends to its policy on international marriages. Airmen who have married internationally are assigned to bases in states that have no legal restriction to such marriages.

By centralizing its control of travel (skilled) assignments, Air Force is able to place personnel moves far enough in advance to get the airmen sufficient time to wind up personal business at his old station and to arrange convenient travel with his family.

To a much greater extent than formerly, airmen are able to attend technical schools of their choice and to choose the EI or overseas base at which they would like to be stationed.

Educational opportunities within the

Air Force are being emphasized.

■ **Pay and Fringe Benefits:** Frequent gripes are heard about the lack of adequate housing for married airmen, and about "fringe benefits," such as medical care for dependents. These are all fields in which Air Force is looking for improvement.

Of course, higher pay would please everybody, but USAF must operate within its budget. Finances are considering a system of "selective raises" in the form of higher retirement benefits for those whose specialties are most needed.

However, the case for a general increase is strong. Since 1959, the average airman's pay has gone up 130%, the average officer's 19%. In this time, the cost of living has jumped 200% and the average wage for labor 185%.

The President has asked Congress for an increase in pay rates and allowances. In addition, he calls for a "deduction" allowance for military personnel with dependents who are ordered to a new permanent duty station. He asks for more housing, a better deal in medical care for dependents, an increase in travel allowances, and better pay for those engaged in hazardous duties.

■ **Insanity About Severity:** One of the strong points that military service has to offer, Air Force's surveys show, is the liberal retirement policy. However, there is a "telling of insanity about severity," Air Force says. There is the feeling that Congress gives and Congress can take away. Military people have seen how political pressures have been directed against necessary privileges for soldiers.

Manpower planners in the Pentagon believe they must make a few stand as the if they are to keep their needed personnel. Whatever fringe and retirement benefits military people now have they must keep, and Congress must make it clear that these are permanent, Air Force spokesmen say.

■ **No Draft for AF:** Although the military assignments program proposed by the Administration calls for a drop to 2,315,000 (including a somewhat larger Air Force of 975,500) by June 1956, from the present levels of 3,215,000 and 965,000, in the absence of any considerable emergency a draft will still be required to fill the gaps.

However, Air Force, in company with the Navy, steadily maintains a most lax, loosey-relaxation, and doubtless, if it is to maintain its standard of "quality, not quantity." This is the job of the Recruitment Branch. The next few years will tell how successful its program has been.

Industrial Manpower

The production manpower situation on the aircraft and allied industries



Building Boeing airplanes is a nation-wide project

America's global jet bombers—B-52s like the one shown above—are selling off Boeing's production lines in steady numbers. Although this B-52 production is centered in Seattle, it incorporates the efforts of businessmen and workers located from coast to coast, and from Canada to Mexico.

At least coast, more than 5,000 firms are supplying material, equipment or service for aircraft built by Boeing's Seattle Division. Of these, some 5,000 are well businesses having 500 employees or less.

Smaller emphasis on subcontracting is the rule at Boeing's Wichita Division. Here Boeing builds the Strategic Air Command's front line nuclear weapons carrier, the superb B-47, and is making up for B-52 second-source production. No fewer than 5,588 in divided companies, more than 75% of them small businesses share the work of this Division.

Out of every Air Force dollar committed to Boeing, approximately 45 cents is given or by Boeing to its subcontractors and suppliers. The as-

sembly—about 35 cents out of each dollar—is retained by Boeing to cover all costs in connection with its own airplane operations. Boeing airplanes are truly nation-wide projects.

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Regulus Missile Gets Cleanup

Chlorine Vapour Regulus missile-cleaning inside is noted in this column pg. 20 to exhibition of its heritage, to disperse the lot of every unit, which helps a lot of the way there during assembly. A

small power drill inside the Regulus like a battery on a rope, changing the work out. About a hundred collected from each missile, the company states. Now under study is a winter to this way back.



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IAS Summaries

More than 50 presentations on the state-of-the-art of aeronautics featured the annual meeting of the Institute of the Aeronautical Sciences this year. From this large group, **AVIATION WEEK** has selected representative summaries for publication.

This is the first installment of the story that began in the issue of Feb. 14. Responses for reports of the papers should be directed to the Institute of the Aeronautical Sciences, 2 East 64th Street, New York City.

Air Transport

► **Direct Use of Rotating-Beam Colimeter and Transmittance in the Reporting of Cloud and Visibility.**—C. W. Moore, Meteorologist in Charge, Weather Bureau Airport Station, New York Field.

The development and characteristics of the rotating-beam colimeter and cloud colimeter are described briefly. Preliminary experiments with the new instruments by the Weather Bureau at New York and at Washington National Airport are discussed.

► **A Flight Investigation of the Performance of Low-Cutting Visibility Measuring Equipment.**—K. F. Scoggins, Chief Engr., New York Field, New York City.

The Air Navigation Development Board in cooperation with the United States Weather Bureau has conducted a flight test program to evaluate specifically the first atmospheric visibility device of measuring low cutting/visibility visibilities with respect to what pilots see from the cockpit during actual weather ILS approaches.

► **A Review of High-Altitude Cabin Pressurization Design Criteria in Relation to Future Transport Development.**—M. H. Black, Staff Engr.—Glenn, Beach, Appleby Co.

The problems associated with high altitude flight for transport aircraft, being designed and planned for commercial operation are presented. Methods of obtaining probability and value of passenger cabin for crew working fatigue or other damage are outlined.

► **Design Considerations for Turboprop-Powered Cargo Aircraft.**—Waldorf H. Ames, Jr., Project Design Gr. Engr., Lockheed Aircraft Corp.

The purpose of the paper is to discuss some of the design considerations and economic aspects of operating commercial turboprop cargo aircraft.

The presentation is divided into two primary sections. First, cargo loading and cargo handling problems related to airplane design are presented. Particular attention is given to aircraft whose cargo loads will approach 50,000 lb.

The second part of this paper investigates the effect of turboprop engines on the operating costs of cargo airplanes. In particular, the direct operating costs of three different airplanes, over the Los Angeles-Chicago route are presented. Detail factors in the

ATA cost formula are related to the total direct operating costs for each model.

Flight Safety

► **In Cooperation with The Design and Flight Data Department, Aviation Safety Committee at Cornell University.**

► **Escape from High-Speed Aircraft.**—Richard H. Pratt, Vice-President, Safety Aviation Corp.

A brief survey is presented of the evolution of emergency escape devices for high-speed aircraft. The original German and English developments which led to the late U. S. Navy version are described and the fundamental research done by the U. S. Air Force is outlined.

► **Design Safety Aspects of the Boeing 707 Jet Transport.**—E. W. Norris, Aeronautical Engr., Boeing Aircraft Co.

Basic design safety philosophy of the Boeing 707 jet transport is described. Methods of analyzing and obtaining operating experience from military and civil aircraft are discussed. Reliability analysis and its contribution to the probability of hazardous failure are discussed. Problems as they arise or may be encountered in the future are discussed.

Flight Propulsion

► **Relaxation Phenomena in Turbine Engines.**—R. E. Kuhl, Jr., Engr., Design and Production, Small Airplane Design Dept., General Electric Co.

The objective of the paper is to compare the performance of a bare 1,300 HP engine leaving its combustion system at the turbine to one having its turbine section in an abraded state.

Experiments were performed with various efficiencies at altitudes of 20,000, 40,000, 60,000, and 80,000 ft. over a range of flight Mach numbers .50 to 2.0. Single

point data for pressure ratios of 4 thru 5 were used to select the design point.

At altitude 40,000 ft. 100-1000 in. the loss in total engine output to the characteristic efficiency of the turbine was apparent in specific fuel consumption and not related to the engine burning in the characteristic in an abraded state.

Helicopter Dynamics

► **In Cooperation with the American Helicopter Society.**

► **Notes on the Effect of Rotational Oscillations on Helicopter Blade Flapping.**—Robert J. Timpani and F. H. Gifford, Asst. Research Scientists, Langley Aeronaut. Lab., NACA.

An empirical study, using conventional types, blade loading, clearance for high-performance, higher speed helicopters is under development to provide and to evaluate a study. Accordingly, a study is being conducted to determine the present state of knowledge.

Jets for Aircraft

► **In Cooperation with the American Rocket Society.**

► **Zero-Length Launch for Missile—G. J. Eddy, The Glenn L. Martin Co.**

Experiments of zero-length launch tests were for the Air Force TM64 Missile, which resulted in the world's smallest jet port for a tactical bombardment missile, as described in this paper. It also describes the design problems encountered and solved and in addition gives some historical data on the testing program.

Supplementing the paper is a short movie picture showing some of the only zero-length launch tests at Aberdeen Proving Ground, together with recent tests of missile launchings, including weight and internal data points.



Connie Family Brings in More Than \$1 Billion

More than \$1 billion in orders have been gained by Lockheed Aircraft Corp. as a result of steady development of its original Constellation transport (No. 1, left) which first flew in 1945. This cluster of transports at Burbank, Calif. typifies some of the growing Super Constellation models. No. 1 (foreground) is President Eisenhower's personal transport, Columbine 1. No. 2 is a

Near-MATS E77A. No. 3 is now a "Flying Classroom," No. 4, Seaward 4 Western Airlines. No. 5, Airborne (California) transport, No. 6, USAF KC-131D under early warning project. No. 7, Near WW2 color early warning project and No. 8, RTV-2 helicopter-powered prototype. First Constellation weighed 72,000 lb., latest Super Constellation weighs 119,000.

Stretch Forming Control Improved

- New technique assures constant elongation.
- Material and machine variables minimized.

By Irving Stone

Tamers, Calif.—A technique that promises new accuracy of control for aircraft parts production in stretch forming was demonstrated here in a first public showing to a group of about 250 representatives of machine builders and allied activities in the aviation field.

Known as positive position forming, the process was perfected by Sheriden Grey, Inc., a research and development division of stretch press builder T. W. & C. B. Sheriden Co.

• **What It Does**—The process is designed to provide a definite, accurate relationship between the stretch form gun and the die during the entire forming operation—a control not available on existing stretch-forming machines, according to Sheriden Grey. Sheriden Grey's vice president said general manager.

The part being formed is elongated by positive linear dimensional control only. It is a constant and repeatable elongation according to a preset unit value. Effect of variables in the material is minimized, variables in the machine and operator are eliminated.

• **Efficient Operation**—Grey says up the new process this way:

"It is as big an improvement over the existing stretch-forming process as the letter 'w' over 'hand-forming.'" Grey says his positive position forming process is the solution for the majority of problems encountered in present day stretch-forming.

These include overoperative spring-back, operator error, lack of sensitivity of large-capacity machines when forming small cross-sectional parts, reduction of work on the die, inadequate control of elongation due to variations in dimensional and physical properties of the part, and variations in operating conditions (pump pressure, packing friction) of the machine's tension cylinder.

• **Basic target** is to incorporate the control in all Sheriden stretch-forming machines now operating as plants in use by itself as the future.

• **Second objective** is to offer to the air-



STRETCH TAPES fed into stretch area gun of 20-ton Sheriden forming machine.

craft industry a control package to fit size scale of stretch part now operating. In most cases, acceptance of the control would involve only a minor modification—changing the tension cylinder's valve control to incorporate a hydraulic sense valve, addition of an operator's master control lever.

Highlights

Outline of the template of the part being formed is a preformed, stretched metal strip fixed between tension and compression at the part. Difference between pressure of stretch and that of the outside of the stretched part is equal to the desired percentage of elongation. Template is only cut from plywood.

Forming area is equipped with steel tapes stretched in a gun located at center of template position. Tapes progressively follow template contour during forming transfer part's linear dimension to forming unit.

Forming unit is equal to any metal strip as long as it is wrapped around template. Springs mounted through universal joints in hydraulic servo-valve maintain constant relative position of the gun to the die.

Servo-amplifier the amplifier signal from the sensor of the die to the hydraulic sense valve, due to the elongation of the part, due to the forming cycle is completed.

transmitter and pickup unit, and servo amplifier.

Price of the installation on a 20-ton Sheriden tension stretch press would run about \$5,750.

• **Advantage**—Semi-Positive position forming process is designed to:

• Form extremely small cross-sectional parts on high-tonnage stretch-forming machines. On existing machines the maximum satisfactory casting square (forming cylinder part) is about 10% of maximum. Grey claims, whereas with positive position forming the value can be dropped to 3% of maximum.

This means that a 20-ton stretch press (maximum size for industrial) can be used for a wide variety of work, eliminating the need to put small parts on a small press.

• **Afford consistent elongation.** Because each part fits a particular mold is designed the same amount without being adversely affected by the variables in the material and machine, the resulting springback is consistent, part to part, Grey says.

This means that the form die may be universal to allow for springback, first giving parts a consistent configuration. This, in turn, means that many times an aluminum alloy part can be cast in the Tensidolite (hard) to eliminate the necessity of heat treat and a second oxidation operation.

Also, because elongation is consistent, part tolerance due to excessive stretching is practically eliminated. The amount of hand-forming (after forming)



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is considerably reduced. Another big advantage, Gray says, is that the constant elongation across the design engineers had the structural characteristics shown by test for parts from a first run on the machine will be matched in the successive parts.

- Reduce stock length. Because stretch during is eliminated between stock and die during the forming operation. (This is caused by having drawing steps lead to a continuing pull on the wire.)
- Reduce operator error. Relationship between parameters of die and template eliminates the amount of elongation. Thus, a 10-in. parameter template would be used in conjunction with a die having a perimeter of 106 in., to give a 6% elongation. At the start of the stretch forming, the actual length between the jaws would be 100 in.

In this way, the tooling (template) controls the elongation; the operator has no control over it. On existing machines, elongation is controlled by operator adjustment of hydraulic pressure. Gray points out. Also, at the completion of the forming cycle the pressure is released by the set of the material. With positive position forming, this final stretch is not necessary.

- Runs with Titanium Alloy—Because of the small spread between yield and ultimate strengths of titanium alloy, it is very difficult to control elongation by control of cylinder pressure—very often in the hydraulic circuit and the part itself because very critical.

By controlling elongation, drawn steadily with positive position forming, the small spread between yield and ultimate is no longer. Gray says. Duty consideration is the allowable elongation of the material.

For example, Sheridan Gray says a

series of titanium alloy (KC-144) parts in conjunction with a major aircraft manufacturer. These parts were 627 in. Zircronium about 14 in. high with 1 in. legs and about 95 in. long—typical fuselage systems in the aircraft area.

- Results—At the recommendation of the aircraft manufacturer, a 10-in. cycle was established for stretch-forming to the 100-draw band. The template was selected to produce a 4.6% elongation in the outer flange of the part, since the aircraft manufacturer had specified 5% maximum elongation. Sheridan Gray found 19 parts with very satisfactory results, it is reported.

The aircraft manufacturer was able to form the titanium alloy parts fully under laboratory conditions (with approximations by methods development personnel), it is said, but couldn't duplicate this in the shop under actual production conditions—where various factors of operator error, machine variations. Under the production conditions, part leakage was excessive.

- Big Machine Shake—An engineering analysis is underway, aimed at getting the positive position forming control on the world's largest steel press—Sheridan 750 ton unit which will form 14-ft by 30-ft slabs. This press is now installed at the plant of a West Coast aircraft manufacturer.

Companies represented at the recent demonstration of the positive position control included Boeing (Seattle), Convair (San Diego), Northrop (Downey), All American (Larchmont, N.Y.), Rohr, North American (Los Angeles) and Columbia, Chance Vought, Mitsubishi Heavy Industries, Messerschmitt, Northrop, Lockheed, and many others.



P&W Ships Its 1,000th J57

Port & Whitney Aircraft General Manager William F. Green looks at the 1,000th J57 turbine built by the firm as the powered was being prepared for shipment from East Hartford, Conn. Delivery version of the J57 is producing more than 11,000 lb thrust when after burner (Aviation Week Feb. 28, p. 11).

more from East Hartford, Conn. Delivery version of the J57 is producing more than 11,000 lb thrust when after burner (Aviation Week Feb. 28, p. 11).

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OUT FOR THE NIGHT is the Boeing B-52 Stratofortress being moved off the company's mobile production line.

Boeing Says B-52s Are 'On Schedule'



THREE ON THE LINE: final assembly runs at Boeing-Renton shows three of the giant bombers nearing completion and pairs of at least six others. Tail turret of first plane reveals unusual shape.

• Boeing B-52 Stratofortress production, now concurrent at the Wichita, Kan. division and the Seattle main plant, is the largest portion of the company's reported two-billion-dollar backlog.

Boeing reports both plants "on schedule," answering a recent statement by Sen. Richard D. Russell, chairman of the Senate Armed Services Committee that B-52 production was slipping.

First deliveries to USAF of the eight jet bomber will start later this spring; first unit to get the 600 mph plus bomber will be SAC's 35th Bomb Wing, Castle AFB, Monro, Calif.

► In One Year—First production B-52A rolled out not nine days, made its first flight Aug. 5. Production airplanes have come out at the huge doors of the Seattle plant at regular intervals since then.

Some timing troubles, common to any new airplane, caused minor delays in flight test and elsewhere, says a company spokesman. But he explains that the B-52 has been available "log-wise," considering size and type.

Current practice is to fly production airplanes from Boeing Field, Seattle, to the new \$10-million facility at Larson AFB, Moses Lake, Wash. Final installation of equipment and production flight test programs are conducted there. First B-52 was delivered on Feb. 15.

► In Kansas—The Wichita division has moved major components from jigs to final assembly, where more is shared with production of B-47 Stratojet.

Some indication of the production capacity of Wichita was furnished last year when Boeing delivered the 1,000th Stratojet to be built at that plant.

Among these powers are the first to be taken of Boeing's second-source production for the B-52.

Latest specifications released by Air Force on the B-52 specify max. take-off weight with a range of more than 6,000 tons, and state that Boeing-Fleming Boeing used refueling equipment is standard. A crew of six flies the 152,000-lb. plane.

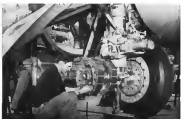
Other specifications: Wingspan, 155 ft.; length, 155.5 ft.; height, 49.5 ft. Powerplants are eight F4WA (J77 P-1) turbojets rated at 10,000 lb. thrust. Armament: four 15-cm. nuclear missiles. Boeing built an experimental XB-52, a seven-ton YB-52 and a limited group of B-52As. Current production models are split between B-52B and RD-52B. In addition, USAF sources list a contract for 50 B-52Ds.



LOWER PANEL of B-52 wing is hoisted out of construction jig at Wichita.



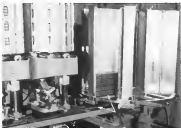
CENTER SECTION of B-52 comes out of jig ready for final assembly at Wichita.



MAIN GEAR is built by Bendix, Cleveland Aircraft, Inc., wheels and hubs by Goodrich.



AUTOFAB, new device for automated assembly of electronics, consists of a battery of placement heads (1 inch in which units) mounted on a conveyor (left from bottom segment) or printed circuit boards which are supported to conveyor at end of line (right).



Autofab Sparks Automation Race

By Philip Kline

"Autofab," General Mills' new machine for automated assembly of electronic equipment, has jumped into a leading competitive position within weeks after its public unveiling (Aviation Week Feb. 21, p. 7).

Several TV-radio manufacturers have placed firm Autofab orders. Other companies, including firms in the avionics field, are negotiating for the machine. A General Mills spokesman says company sales are not being divulged yet.

The first Autofab—capable of turning out printed circuit boards with 24 conventional components installed automatically at a rate of 10 boards per minute—has been delivered to International Electronic Machinery Corp., where it will be used to build large digital computers for an defense. A computer unit would cost approximately \$90,000, with delivery quoted at six to eight months.

With firm orders under its belt, General Mills appears to have the jump on United Res. Machinery Co. and Adcofab Corp., which earlier developed mechanical assembly machines for placing conventional components in printed circuit boards.

Extent of industry interest in Autofab is evidenced by the report that all major TV-radio and computer makers

have sent representatives to Minneapolis for a firsthand look at the General Mills machine.

•**Neatly Automatic.** Factory-Autofab is the last end of line automated machines now in various stages of development. Finally they will prepare components, mount them on a printed board, dip solder the assembly, test all circuits and then give it a protective coating—all automatically.

Autofab itself consists of a battery of component attaching units (24 on the IBM model), each of which installs a single type of component. The type of component installed at each station can be changed quickly and easily by substituting a new placement head. Printed circuit boards, loaded in a carrier magazine, feed out on a conveyor under the line of attaching heads.

When the boards reach the proper position, the conveyor stops momentarily and all heads simultaneously install their components. The conveyor then starts up, advances the boards one station and the procedure is repeated.

One attaching head is required for each different component to be installed. Each head is fed from an eight-magazine barrel that rotates automatically when one magazine exhausts its components. This permits re-loading with new magazines without interrupting the line's operation.

Prior to delivering the first Autofab to IBM, General Mills began work on five more units that it expects to complete within six months.

•**Other Key Features.** The enclosed machine, which will further mechanize the production of electronic assemblies, includes:

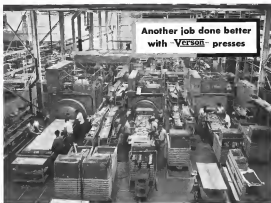
•**Component preparation machine.** Conventional types of components changed into this device's hopper will come out with their leads straightened, cut to size (with wrap-around sleeves on the leads if standard type mounting is desired) and loaded in magazines ready for installation on Autofabs. One work magazine will be able to service at least five attaching heads.

The first of five component preparation machines now under construction is completed and ready for delivery. Four more are under way to go. Four of these five are designed to handle conventional resistor components, such as resistors and capacitors with lead extending from each end. The fifth machine is for components such as pulse transformers, which have two leads on one end.

A component preparation machine can handle a small range of different sized components without changing the setup. This requires only a quick change of face tool to take a new range of sizes. For instance, the device might

handle .008, .010, .012, .014, .016, .018, .020, .022, .024, .026, .028, .030, .032, .034, .036, .038, .040, .042, .044, .046, .048, .050, .052, .054, .056, .058, .060, .062, .064, .066, .068, .070, .072, .074, .076, .078, .080, .082, .084, .086, .088, .090, .092, .094, .096, .098, .100, .102, .104, .106, .108, .110, .112, .114, .116, .118, .120, .122, .124, .126, .128, .130, .132, .134, .136, .138, .140, .142, .144, .146, .148, .150, .152, .154, .156, .158, .160, .162, .164, .166, .168, .170, .172, .174, .176, .178, .180, .182, .184, .186, .188, .190, .192, .194, .196, .198, .200, .202, .204, .206, .208, .210, .212, .214, .216, .218, .220, .222, .224, .226, .228, .230, .232, .234, .236, .238, .240, .242, .244, .246, .248, .250, .252, .254, .256, .258, .260, .262, .264, .266, .268, .270, .272, .274, .276, .278, .280, .282, .284, .286, .288, .290, .292, .294, .296, .298, .300, .302, .304, .306, .308, .310, .312, .314, .316, .318, .320, .322, .324, .326, .328, .330, .332, .334, .336, .338, .340, .342, .344, .346, .348, .350, .352, .354, .356, .358, .360, .362, .364, .366, .368, .370, .372, .374, .376, .378, .380, .382, .384, .386, .388, .390, .392, .394, .396, .398, .400, .402, .404, .406, .408, .410, .412, .414, .416, .418, .420, .422, .424, .426, .428, .430, .432, .434, .436, .438, .440, .442, .444, .446, .448, .450, .452, .454, .456, .458, .460, .462, .464, .466, .468, .470, .472, .474, .476, .478, .480, .482, .484, .486, .488, .490, .492, .494, .496, .498, .500, .502, .504, .506, .508, .510, .512, .514, .516, .518, .520, .522, .524, .526, .528, .530, .532, .534, .536, .538, .540, .542, .544, .546, .548, .550, .552, .554, .556, .558, .560, .562, .564, .566, .568, .570, .572, .574, .576, .578, .580, .582, .584, .586, .588, .590, .592, .594, .596, .598, .600, .602, .604, .606, .608, .610, .612, .614, .616, .618, .620, .622, .624, .626, .628, .630, .632, .634, .636, .638, .640, .642, .644, .646, .648, .650, .652, .654, .656, .658, .660, .662, .664, .666, .668, .670, .672, .674, .676, .678, .680, .682, .684, .686, .688, .690, .692, .694, .696, .698, .700, .702, .704, .706, .708, .710, .712, .714, .716, .718, .720, .722, .724, .726, .728, .730, .732, .734, .736, .738, .740, .742, .744, .746, .748, .750, .752, .754, .756, .758, .760, .762, .764, .766, .768, .770, .772, .774, .776, .778, .780, .782, .784, .786, .788, .790, .792, .794, .796, .798, .800, .802, .804, .806, .808, .810, .812, .814, .816, .818, .820, .822, .824, .826, .828, .830, .832, .834, .836, .838, .840, .842, .844, .846, .848, .850, .852, .854, .856, .858, .860, .862, .864, .866, .868, .870, .872, .874, .876, .878, .880, .882, .884, .886, .888, .890, .892, .894, .896, .898, .900, .902, .904, .906, .908, .910, .912, .914, .916, .918, .920, .922, .924, .926, .928, .930, .932, .934, .936, .938, .940, .942, .944, .946, .948, .950, .952, .954, .956, .958, .960, .962, .964, .966, .968, .970, .972, .974, .976, .978, .980, .982, .984, .986, .988, .990, .992, .994, .996, .998, .1000, .1002, .1004, .1006, .1008, .1010, .1012, .1014, .1016, .1018, .1020, .1022, .1024, .1026, .1028, .1030, .1032, .1034, .1036, .1038, .1040, .1042, .1044, .1046, .1048, .1050, .1052, .1054, .1056, .1058, .1060, .1062, .1064, .1066, .1068, .1070, .1072, .1074, .1076, .1078, .1080, .1082, .1084, .1086, .1088, .1090, .1092, .1094, .1096, .1098, .1100, .1102, .1104, .1106, .1108, .1110, .1112, .1114, .1116, .1118, .1120, .1122, .1124, .1126, .1128, .1130, .1132, .1134, .1136, .1138, .1140, .1142, .1144, .1146, .1148, .1150, .1152, .1154, .1156, .1158, .1160, .1162, .1164, .1166, .1168, .1170, .1172, .1174, .1176, .1178, .1180, .1182, .1184, .1186, .1188, .1190, .1192, .1194, .1196, .1198, .1200, .1202, .1204, .1206, .1208, .1210, .1212, .1214, .1216, .1218, .1220, .1222, .1224, .1226, .1228, .1230, .1232, .1234, .1236, .1238, .1240, .1242, .1244, .1246, .1248, .1250, .1252, .1254, .1256, .1258, .1260, .1262, .1264, .1266, .1268, .1270, .1272, .1274, .1276, .1278, .1280, .1282, .1284, .1286, 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.3576, .3578, .3580, .3582, .3584, .3586, .3588, .3590, .3592, .3594, .3596, .3598, .3600, .3602, .3604, .3606, .3608, .3610, .3612, .3614, .3616, .3618, .3620, .3622, .3624, .3626, .3628, .3630, .3632, .3634, .3636, .3638, .3640, .3642, .3644, .3646, .3648, .3650, .3652, .3654, .3656, .3658, .3660, .3662, .3664, .3666, .3668, .3670, .3672, .3674, .3676, .3678, .3680, .3682, .3684, .3686, .3688, .3690, .3692, .3694, .3696, .3698, .3700, .3702, .3704, .3706, .3708, .3710, .3712, .3714, .3716, .3718, .3720, .3722, .3724, .3726, .3728, .3730, .3732, .3734, .3736, .3738, .3740, .3742, .3744, .3746

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FINANCIAL AID TO HIGHER EDUCATION

Our Colleges and Universities Are Living on Borrowed Time

... time borrowed from underpaid faculty members

The chart on this page tells a story of profound importance to every American. It is the story of the financial leeching our college and university faculty members have been taking in the past 14 years and probable years.

On the whole, this span of 14 years has been one of great and growing prosperity. But, as the chart shows, our college and university faculty members have, as a group, had less than no share in it.

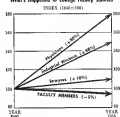
During this period, from 1940 through 1954, the real income of the average industrial worker (that is, what his wages would purchase in goods and services) has increased by almost one-half. Among professional groups, physicians have enjoyed an increase of about 80 per cent in their real income. Lawyers, far less favored financially, have had an increase of about 10 per cent. But faculty members have not only had no increase at all; over those years of prosperity their average real income has fallen by 5 per cent. These figures do not take account of the increase in taxes since 1940.

Senior Teachers Hardest Hit

These figures are, of course, averages. For some groups of faculty members it has been better; for others worse. It has been particularly

hard on senior faculty members. Between 1941 and 1953 their salaries lost about 8 per cent of their purchasing power. Being deeply committed to their careers they could not respond to alternative employment opportunities as readily as could their junior colleagues. For junior faculty members there was some increase in real income between 1941 and 1953 but only about half as much as the average for the nation.

What's Happened to College Faculty Salaries*



* Real Income Index.

Source: Council for Financial Aid to Education; U. S. Dept. of Commerce; U. S. Dept. of Labor.

Public Colleges Fare Better

There are also marked differences in the average financial reward received by faculty members in different types of colleges and universities. A recent study by the Council for Financial Aid in Education indicates that, in the last academic year, 1953-1954, teachers in privately endowed, independent colleges and universities were paid an average salary about \$1000 less than that paid to faculty members in non-subsidized institutions. The same study indicates that salaries far below the average are especially common for faculty members in the small private liberal arts colleges. This study found that during the last academic year the average salary of all college and university faculty members was about \$4700.

The special difficulties under which the independent colleges and universities, and particularly the independent liberal arts colleges, are laboring to get back on their feet financially have been discussed in previous editorials in this series. These difficulties underline the need of special help for these institutions to which business firms are now contributing in increasing volume. However, the problem of providing better salaries is not peculiar to any particular type of institution.

Faculty Members Not Greedy

It is not easy to prescribe a precise standard of fair pay for college and university faculty members. This is partly because they put less weight relatively on money rewards than they put on rewards of scholarly accomplishment and prestige. Consequently, they have consistently been willing to work for very modest salaries in relation to the intellectual ability, education and application required. Obviously, however, it is the desire both of fairness and good judgment to see that faculty members are given a roughly proportionate share in the general prosperity. Indeed, their crucial role in our society could be made to justify a larger share than this.

There is no way to know with any degree of precision what the underpayment of our college and university faculty members over the past 14 years has actually cost the nation in terms of reduced quality of intellectual performance of those institutions. One reason is that the damage has been inflicted by the devoted services

of many faculty members who have loyalty stuck to their jobs in spite of the great financial discouragement.

It is obvious, however, that, if no grave deterioration in the intellectual performance of our colleges and universities has occurred so far, it is because we have been living on borrowed time. It is time borrowed from faculty members who have, in effect, been subsidizing these institutions by their financial sacrifice. This arrangement is not only a menace to the cultural and intellectual life of the nation, it is also a menace to our national security in a time when successful national survival may well depend in peculiar degree on the full development and utilization of our intellectual resources. We depend on our college and university faculties pre-eminent to provide this development. Adequate financial reward for such service is an elementary form of national insurance.

Many of our colleges and universities are working hard to improve the financial lot of their faculty members. Business firms are also playing an increasing role of providing the necessary financial assistance. The methods being used by business for this purpose will be the subject of another editorial in this series. However, vastly more must be done, and quickly, to stop the financial bleeding being taken by our college and university faculty members if the nation's welfare and safety are to be properly protected.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help business public knowledge and understanding of important economic developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McLean
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LETTERS

Gen. Weyland's Book

In the Washington Kennedy volume of your Feb. 7 issue (p. 12), you talk about Air Force difficulties in getting Department of Defense approval for a book written by Gen. G. P. Weyland. Your article contains references to specific details which are included in the book.

For your information and the information of your readers, Gen. Weyland has not written a book. I assume your article was intended to explain the fact that a large New York publisher asked Gen. Weyland, through the headquarters, if he would be interested in writing a book about the Korean war. Gen. Weyland indicated he would be interested providing the idea was approved by Headquarters, USAF, and the Department of Defense.

The proposed book, as conceived by the publisher, the Air Force, and Gen. Weyland, would be a "broad, non-controversial narrative of the role of the war heroes in the Korean war as seen by the men who commanded the forces throughout the war. Primary consideration of the book would be the treatment of tactical and strategic aspects of the war in the air. Special ranges and study would be given the roles played by other services in the combined theater strategy." This is the exact statement that appears in the official correspondence concerning this project.

P. J. ALLEN
Regulation Counsel, USAF
Director of Information Services
Department of the Air Force
Washington, D. C.

(Editor's note: Both the office of Paul Sartre, then Assistant Secretary of Defense for Public Affairs and Gen. Allen were quoted by Aviation Week staff men on status of Gen. Weyland's book before publication of this column in question. Neither office did in furnish the information supplied by Gen. Allen until after publication of the item. Aviation Week is sorry if it caused Gen. Weyland's library efforts since he may of the Korean war should be told to the Aviation people who wrote this Postscript column.)

Navaid Decision

The ANDB plan of action described in Feb. 14 issue of Aviation Week (p. 18) states that VOR/DME beacons are not going up. Thank God they are not.

It is difficult to conceive that the existing Citizens Bureau would be accepted as a form of Ticon, which at present would be as small and unworkable. This conclusion is ANDB's advisory committee's decision. The present Ticon equipment is operable and contains all engineering of both ground and airborne units in accurate.

The conclusion also report that "These cannot be expected to add the requirements for two-way voice communications with aircraft."

In addition, the conclusion also—"Before making any plan for widespread use of Ticon, it would be necessary that the pub-

lic of conditions with other services in the 960 to 1215 mc. band be carefully studied and resolved."

We imagine that probably everyone in civil aviation, including every ATIS station, will not give up but will fight hard to maintain the service provided by DME and VOR.

LAWRENCE F. ZIMMERMAN
President
Omni-Aircraft Supply Corp.
Detroit 1

ANDB Decision

According to the Detroit News February 26 and February 28 dispatches indicate at least two congressional investigations into the ANDB decision not underway; and that the General Accounting Office is in the act.

With this stream of action from the airways center leading in Washington, we are greatly disappointed to note that Aviation Week reported only parts of the ANDB press release, then went back, then dropped the whole thing like a hot potato.

It is possible that Aviation Week has lost the ability it once had to dig out all of the facts in a controversy as big as this one, and report them properly.

LENNY BLUMEL
President, Northwestern
Aviation Corp.
Aurora, Pennsylvania

(Aviation Week reported the congressional investigations of the DME/VOR controversy March 7 p. 14 and on March 14 p. 29. Aviation Week was the first to reveal the VOR/DME controversy and present a detailed report on March Dec. 7, 1953, p. 49—Ed.)

Slopline Lights

J. M. GARY FRANK'S note to the editor on the Slopline lights in the Feb. 11 issue of Aviation Week is probably comparable to mine and some other people.

Everyone naturally hates to have his child grow up to be a sort of juvenile delinquent. All divisions of the Slopline system, in an absolutely recently manufactured model.

But it's not let personal feelings cloud the nature of this thing. No product (in this case the Slopline) is a good product if the consumer (in this case the pilot) don't like it or a good product and a better respect a product (in this case the Center line system) is available to be made better.

His attack on Captain Robinson is thus equally misplaced. What Captain Robinson wants may have been exclusively his own words, but it is an opinion shared by thousands upon thousands of pilots.

While Mr. Frank speaks of thousands of test flights, he neglects to mention that the Slopline has not proved themselves in the real and final test ground—actual operations, under actual conditions. A few test flights are insignificant considering the experience gained in years of day-to-day flight operations putting the lights in hundreds of thousands of tests.

The Centerline system has been approved at both the national and international level—and it is still open for the relative merits of the two systems.

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● LETTERS

adversely against the Shipyard. It seems to be a case of Mr. Freeman selling himself up against the interests of LSCB.

The named should be set straight on the
 To Menz, Dorian
 Polarity and Public Relations
 Air Line Flight Agent
 11th Street and Canal Ave
 Chicago 18

VFR Traffic Law

It was gratifying to note that last year helped my letter of Dec. 13. It is struggling out only a few water-repellent pellets, there at least some little good has been done.

I am, however, disappointed with Task 2. First, you copied the last paragraph. The first sentence of which was of no consequence. Nevertheless, the remainder was repeated. Second, you did not point out anything. Perhaps you had some beautiful reasons for not doing so.

I do feel, however, the suspicion left was that I hesitated to record my name. Such is not the case, and moreover is certainly not an admission. Any statement of true fact and personal conviction should have a true signature.

A. G. Wiers, pilot
Executive Officer
Boulder Aviation Corp.
Pikes Peak
District 2

Editor's Note: Mr. White is "AGW", the notorious pilot whose comments on the VFR traffic he observed in the Jan. 17 issue of *Aviation Week*, p. 110. Following is the portion of his letter previously quoted: "Well, this little episode sounds quite tough even to me. Perhaps I'm outspoken, but a situation which has reached the proportions that this case has must be called to the attention of the CAA and the general public. It affects everyone who travels by air!"

Flap Retraction

In past Feb. 7 issue under Industry Observer we noted in the second paragraph that airline pilots are plugging for a new safety device that will avoid premature bag reclamation.

We wish to advise that our new Speed Control Instruments, based on the measurement of lift ratio, would have immediately indicated the inadvertent and dangerous flap structure condition. If flaps are inadvertently spread, resulting in subsequent loss of lift, the Speed Control would show that not more in indication would immediately be given. The action the

This concept of measuring lift stress was reported by AUGUSTUS WHEEL in the May 21 1913, page 12, 67.

This instrument principle is significant
because it compares and contrasts for any
and all factors affecting wing lift.

E. R. Dyer, Jr.
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IT'S ALL A MATTER OF DEGREES!



The 'rotors are coming ... and coming fast—and Harrison keeps them cool! Yes, the helicopter is growing up—with new "top-cooler" take-off and landing sites for short-field passenger and cargo service—and Harrison is keeping pace! In fact, Harrison cool presently carry 'rotor chafes flying today ... and there are good reasons for this outstanding leadership. Harrison oil coolers are designed to save weight and space, which are vital when you're carrying a payload. With our unexcelled research facilities, we're always looking for ways to make almost best exchange lighter, more dependable, more durable than ever. If you have a cooling problem, look to Harrison for the answer!

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Easy-to-operate test unit for checking condition of aircraft spark-plug electrodes, is available to commercial users following adoption by USAF.

Push jet and piston magnet plugs may be checked with the device, the manufacturer claims. An oil sprayer prevents high voltage discharge across the gap, reducing any superheating in the substrate type. If the electrode is sound a tube marked "OK" lights up; otherwise a tube marked "NG" is illuminated.

AC Spark Plug Division, General Motors Corp., Flint, Mich.

Specifically compounded synthetic elastomers line the fuel-injection chamber of the connector, which is made up of rubber impregnated fibrous glass. Aromatic fluids such as MIL-R-3134 Type I or Type III can be handled without leakage, according to manufacturer.

The connector is said to be capable of withstanding stress and temperature. Tests included temperatures ranging from -65F to -165F with pressures ranging from 60 psig internal to vacuum pressure of 25 in. mercury. Associated Rubber Co., 2310 Casey St., Long Beach, Calif.

Cooling Blower Goes Into Planes, Missiles

Specifically developed for high-speed aircraft and missiles is a new axial flow cooling air blower is now available to civilian users.



NOSE SPINNER on blower up efficiency.

A novel spinner at the impeller's design provides more effective blade area, reducing stress and increasing flow, the manufacturer states. Blowers can be specified with either nose spinner. Blower body is two inches in diameter and is three inches long.

It produces 60 cu. ft. of air per min. at less than one percent. Power is either 1/2 or 3/4-hp. 115 v. AC. Air Equipment Co., 3246 E. 97th St., Los Angeles, Calif.

Light Hoist Handles Loads to 1,000 Lb.

A hand-operated ratchet-type hoist, that can take up to 1,000 lb. loads, has a rating capacity of 22 ft. of 1/2-in. cable and is capable of being driven with a standard 1-in. hex socket wrench.

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AIRBORNE HOIST weighs under 5 lb. stowed weight of 471 lb. The device meets military specifications for airborne equipment, the maker notes. Western Gear Works, Lynwood, Calif.

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Hand wheels for gips and fixtures for creating shells are of solid aluminum alloy in 4-1/2-in. diam. mass-produced to achieve cost-jugment Tool Specialty Co., 712 E. 16th St., Cleveland.

Non-contact measuring gage can be located 10-18 in. above work, yet accurate handle work traveling at rates up to 2,000 fpm, manufacturer says. Infrared gage measuring is continuous. Industrial Gages Corp., Englewood, N. J.

Fast battery charger of five and 12-v. capacity will also slow-charge a large alternator or can be used for ordinary charging. Model F-550 is portable unit. Model F-950 is wheel-mounted and has automatic timer. Allen Electric & Equipment Co., Kalamazoo, Mich.

Insulated terminal, called Thermagrip, is designed for operation at ambient where temperature approach 430 F., such as for alarm systems. Monsoon pickup is said to be oil and resistance to most oils and chemicals is excellent. Merritt MIL-T-7703A—Bendy Engineering Co., Inc., Norwalk, Conn.



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AVIATION CALENDAR

- Mar. 21-26—Society of Radio Engineers, national convention, Waldorf-Astoria Hotel, Kingsbridge Avenue, New York
- Mar. 29-Apr. 1—American Society for Metals, sixth Western Metal Exposition and Congress, Fox Plaza, Auditorium and Ambassador Hotel, Los Angeles
- Mar. 31-Apr. 1—Symposium on Boundary Layer effects in Aerodynamics, Royal National Physical Laboratory, Teddington, England
- Apr. 4-6—National Fluid Power Assn., 100th annual meeting, Renaissance Hotel, Colorado Springs, Colo.
- Apr. 5-7—Radio Technical Commission for Aeronautics, spring assembly and joint meeting with the Institute of Radio Engineers, Los Angeles
- Apr. 15-17—Association Society of Collocation Engineers, 10th annual meeting, Grand Services, Chicago
- Apr. 14-15—American Ordnance Assn., symposium of Training General Information Committee, Detrick Air Force Base, Ft. Hood
- Apr. 16-20—American Association of Airport Executives, 1955 annual convention and business meeting, El Comandante Hotel, Toluca, Mex.
- Apr. 16-21—Society of Automotive Engineers, Golden Anniversary Anniversary Meeting, Aerospace Production Forum and Aircraft Engineering Display, Hotel Statler and Madison Hotel, New York
- Apr. 15-21—American Society of Mechanical Engineers, Diamond Jubilee spring meeting, including four sessions, Grand Ballroom Hotel, Baltimore
- Apr. 16-22—American Rocket Society, spring meeting, Baltimore
- Apr. 21-24—Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Los Angeles
- Apr. 27-28—American Helicopter Society, 11th annual forum, Hotel Mayflower, Washington, D. C.
- Apr. 25-26—Michigan Aeronautical Conference, University of Michigan, Ann Arbor
- Apr. 25-26—Western regional meeting of Radio Tech. of Navigation, Friendship Airport, Baltimore, Md.
- Apr. 28-30—New England radio-electronics meeting, sponsored by Boston and Connecticut Valley areas of IRE, Sheraton Plaza Hotel, Boston
- May 2-5—Society of Aeronautical Weight Engineers, national conference, Hilton Hotel, Ft. Worth
- May 4-6—Fourth International Aviation Trade Show, 6th Exposition Aeronautique, New York
- May 14—Association of Northeastern College Flying Clubs, annual conference in session, Troy (N. Y.) Municipal Airport
- May 16-20—National Materials Handling Symposium, produced by Chapp & Peck, International Amphitheatre, Chicago
- May 21-24—American Society for Quality Control, 10th annual convention, Hotel Statler and New Yorker, New York
- May 18-20—Federal-Aeronautical Information Council and KIVVIL Royal Netherlands Aeronautics, 4th International Air Display, Ypresburg Aeronautics, The Hague

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Civil Director can help. He'll advise you on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel to attend Red Cross First-Aid Training Courses.** They may save your life.

☐ **Encourage your staff and your community to have their homes prepared.** Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Use Civil Director can show you ads and officials' CD films or literature that you can sponsor locally. Set the standard of preparedness in your plant-city. There's no better way of building prestige and good community relations—and no prouder way of helping America.

Act now . . . check off these four simple points . . . before it's too late.



Congress Retackles Navigation Systems

Three committees mix in debate over merits of Tacan vs. civil DME. Military cites defense requirements.

By Twinkle Stasse

Congress apparently is going to decide again whether there will be a civilian involvement, short range air navigation system and if so, which one—Tacan or civil DME.

Three major Congressional committees have independently arrived at the decision for Navigation and Development Board's decision to substitute the Tacan system for the previously agreed upon VOR/DME system. Complicating the investigation already under way is the proposal of a fourth Congressional group getting into the act and a pending proposal in the Senate for revision of a special joint committee to conduct a full scale investigation into the controversy.

► **Civil Proposal**—Laid off of establishing a joint committee, which was proposed by Sen. Styles Bridges, it concluded recently, however. The proposal has been referred to the Senate Commerce Committee, which is one of the three groups studying the problem.

Other inquiries that would be hard to stop at this point are being conducted by a House Commerce subcommittee and the Military Operations Subcommittee of the House Government Operations Committee. All of these groups are working independent of each other, possibly at cross purposes.

First to hold hearings was the House Government Operations subcommittee, headed by Rep. Chet Halliford. A closed-door meeting with military representatives only, on Feb. 15, 1961, a week later the first and only public session to date was called.

► **Cost To Find Out**—Chairman Halliford set the issue of the hearing when its stated purpose was to determine if Tacan was a "real" proposition. "We're going to find out if this thing (Tacan) is a better thing than the one for which \$117 million has been spent and going to junk," Halliford said. The question is raised, he said, because Tacan has not yet been proven to be operable but there has been production contracts let with the civilian still in the research and development stage.

First witness for the Defense Department was Donald A. Quarles, Assistant Secretary for Research and Development, who defended the military's op-

inion in developing Tacan and the ANDB decision to make it the common system.

The testimony was supported by Air Force Assistant Secretary Trevor Gardner and Cmdr. R. E. Lamb, Navy electronics expert, who detailed the procurement of Tacan from its inception. ► **Deficiency Claimed**—Gardner told the committee the deficiency of VOR/DME for military applications was common knowledge as far back as 1947. He said he thought the military was patting itself in going ahead with its project because of a very real need for tactical equipment. Tacan couldn't be adapted for common use because of weight, he claimed, but acknowledged that doctrinally there is now in process.

The original decision, Quarles said, to install and equip with VOR/DME was made solely by Civil Aeronautics Administration and its implementation tackled with CAA's "typical vigor and aggressiveness." However, he noted, the DME portions of the civil system have been generally accepted by the aviation public. An example cited by Quarles in reflecting the lack of importance of DME to the aviation was the fact that they haven't brought it extensively to public and until the equipment even though the CAA ground equipment was being installed.

The ANDB decision this year to proceed with development of Tacan for eventual use as the common system is in the public interest because it promises a much improved common civil-military system than VOR/DME, according to Quarles. He said there were reasons for making the change now are:

- It will be the least costly to the taxpayer.
- It best satisfies the needs of both military defense and civil systems.
- It minimizes further expenditures for equipment having limited utility.
- **VOR Procurement**—Trevor Gardner and the Air Force has an equally large investment in both VOR and Tacan. But he said, "VOR will be obsolete by 1965 and he said that full use will have been made of the equipment and will have gotten our money's worth."
- **For Tacan**—Quarles said that VOR is outlived by Gardner has been for 26,000 sets of which 24,500 have been received and 8,837 installed. Out of

Tacan History

Chronological history of Navy contract actions for Tacan development, evaluation and procurement.

- | Date | Action |
|----------------|---|
| June 1945 | Development contract to Federal Telecommunications Laboratories for one receiver and (AN-16) and one transmitter (AN-16). |
| June 1949 | Development contract to Federal for AN-16(N-1) and (AN-16(N-2)). |
| June 1950 | Contract to Federal for 18 evaluation models of AN-16(N-1). |
| July 1950 | Ordered acquisition, including evaluation, of evaluation contract. |
| March 1951 | Decided on AN-16(N-1) and (AN-16(N-2)) after evaluation. |
| June 1951 | Letter of intent for production issued to Federal Telephone and Radio Co. |
| December 1951 | Production contract to Federal, let for 18 sets of receiver and transmitter to Standard Carbon and Balluff Laboratories. |
| September 1952 | Production delivered first of 48 AN-16, 21's, balance at succeeding months. |
| May 1953 | Federal delivered first (AN-16) pilot run models. |
| January 1954 | Federal began delivery of production AN-16's, total of 480 sets ordered for production. |
| February 1954 | Production contract with Federal for 1,215 AN-16's. |
| August 1954 | Production contract with Standard Carbon for 1,612 AN-16's. |
| September 1954 | Production contract with Federal for 675 AN-16's. |
| October 1954 | Production contract with Hoffman for 2,171 AN-16's. |
| January 1955 | Delivery began delivery of first 55 AN-16's. |
| March 1955 | Production sets for AN-16 at 90 sets monthly schedule for a total of 1,715 per month by August or September. |

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Tacan Contracts

Following production contracts for Tacan equipment, both aircraft and surface units, have been awarded by the Navy to three manufacturers.

Aircraft Units (AN/ARN-41)

Contractor	Value	Units	Service
Federal Telephone and Radio Co.	\$10,309,455	1,350	Navy
		1,054	USAF
		477	MACAF
Federal Telephone and Radio Co.			
Subcontract to:			
Swanberg-Carlson, Inc.	3,327,484	250	Navy
Hoffman Laboratories	2,194,343	250	Navy
Swanberg-Carlson, Inc.	36,915,464	1,540	Navy
		5,711	USAF
Hoffman Laboratories	21,379,202	730	Navy
		1,280	USAF
Sub-total	\$94,504,200	9,262	

Surface Units (AN/URN-1)

Federal Telephone and Radio Co.	62,304,000	302	Navy
		420	USAF
(Special tooling)	1,458,000		
Sub-total	\$65,762,000	622	

Research and Development

Federal Telecommunications Laboratories, Inc.	\$5,726,852		
Total contract value	\$175,788,758		

and agreed to file these same agencies by the same military representatives, thus insuring democratic form of government is in jeopardy."

3-Cent Airmail

• Post Office wants service put on permanent basis, cites \$154,000 saving.

Post Office Department estimates a saving of \$154,000 so far through the air shipment of first-class three-cent mail on an experimental basis and wants to continue the service as a "permanent basis," according to Postmaster General Arthur Summerfield.

He suggested that a General Accounting Office audit, now underway, would place the department's estimated saving "substantially" correct.

■ Court Action—Post Office has requested Justice Department to appeal the decision of U. S. District Court Judge James Kirkland that the first part of the three-cent mail be air as a permanent basis would require amending legislation. However, Judge Kirkland denied the petition of first-class mail for an exception before the service, reasoning that the postmaster had authority to experiment as long as the test period did not last too long (AW Feb 14 p. 160).

If the appeal is granted, the case will be retried in the U. S. Court of Appeals for the District of Columbia.

"If we find it necessary, we certainly are going to ask for legislative authority to continue the air shipment of three-cent letters on a space-available basis, Summerfield told the House Appropriations Committee. "Because, finally, we consider it not only an economic economy, but as a part of our defense and military program, we feel it is essential that we be permitted to proceed."

Referring to military application to the air shipment of surface mail, Summerfield observed:

"This means to be following in the footsteps of the people that preceded them in the handling of mail and the old days by post agents and who, as I have pointed out, changed because they lost revenue. . . . And apparently the railroads are concerned because they probably foresee what we foresee, that the public having seen the improved service of airmail would not be content."

■ Two choices—He emphasized that "the railroads are removing their mail-carrying trains from their schedules and leaving us to use other means of transport" and at the same time are "having to continue to lose money in operating in the movement of mail by air."

In more cases, Summerfield declared, and agreed to file these same agencies by the same military representatives, thus insuring democratic form of government is in jeopardy."



Richard Covelet, aerodynamics chief, Pen Division, Aerodynamics Division head Stanley and Irving Lippman, aerodynamics engineer and boundary layer control specialist, discuss effects of hovering boundary layer control on lift increments and pressure distribution.

the total 26,000 the Navy has received 4,500 sets through the Air Force with another 700 programmed.

The cost of Tacan is due for the Air Force was estimated at \$300 million to cover of installation costs, which includes more than 5,000 airborne and surface units. Gardner commented that aside from the financial interest in the Tacan program the Air Force has a deep interest in its assigned responsibility for operational defense. This accounts for USAF interest in some of the lighter specifications of the Tacan units, he said.

■ Necessary Steps—Gardner and Quinlan agreed that Tacan has not been perfected as manufacturer to the point where it is suitable equipment.

Halefield asked Covelet, "Why not a research and development contract for some 400 units instead of a production contract for 5,000?"

Covelet replied "It is necessary to put each unit into production before they're ready. If we wait for final development as it is, that includes the B-35, super cruise, what have you, we will be hopelessly behind the enemy. We will be comparing to developing Tacan for the next five years. This goes on in every one of these private units, it just happens to show in this one."

After the two defense department agencies had reviewed each testimony before Halefield's committee, they made the results of the other interested groups. In successive days, they

appeared before Rep. Otto Bern's House Commerce subcommittee and Sen. Wayne Magnuson's Senate Commerce subcommittee. Their successive hearings were clouded in secrecy, despite many declarations that as much of the testimony as possible would be in open sessions.

■ Viewpoints—Rep. Peter Mack said it will be impossible to operate a dual system of navigation. "I think it's important that we make a detailed study of the two proposals," he said.

May Gai Condon A. Blinn, USAF's Director of Communications said:

"VOR, omnirange and the omnirange portion of Tacan are not competitive and not interchangeable with using VOR and will continue to use it, but the distance measuring portion of the civil system (DME) and distance measuring portion of Tacan are competitive and are interchangeable. The latter is the point we're trying to solve."

Cole Morris, National Business Aircraft Assn. representative, said:

"Do we have or have we ever had the common system which Congress and the civil users thought we had and for which Congress appropriated huge sums of money to implement?"

Morris added: "If the military can live on the Common System on an incompatible tactical system, which it has newly developed and which has not been coordinated through the proper channels such as ACC or ANDR and thereby destroy the Common System which has been coordinated, accepted

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2. Estimate maximum speed and altitude capabilities of advanced supersonic military designs
3. Determine a history of vertical rising aircraft to make transition from business jet to vertical flight
4. Estimate direct operating costs of new turbo-prop commercial transport under wide range of operating conditions
5. Estimate design fuel loads on turbo-prop cargo airplane for all types of engine failure
6. Determine ability of new trainer to make carrier landings and catapult take-off
7. Establish design criteria for auxiliary dumping systems/conditions on future fighters
8. Optimize approach and landing technique for use on rough, short fields by rescue aircraft

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complexity by opening incidents."

The safety expert said accidents would:

- Uncover innocent practices and operating complacencies that the pilot or airline accepts without asking the designer
- Check weather forecasts, capacity, turbulence, then adding to the improvement of meteorology
- Aid accident investigations and, in some instances, protect the pilot's reputation
- Explore new operations such as jet and turboprop, for economic and other operational implications

Lodner said flight engineers would accomplish this by recording what the pilot saw or knew during flights and photographing takeoffs and landings.

Airport Standards

Plans at the Safety Forum and the government should set up certified for airports and force them to meet some new safety standards. Many ALPA members declared that imposing requirements to meet the standards should be a local effort, not the responsibility of federal aid.

"Put it on a basis of what an airport means to the community," one speaker. "If they want an airport, then they have to meet professional standards. If they want to attract industry or keep what they have, an airport is a must."

• **Pilot Problem**—Theodore G. Lodner, chief of ALPA's engineering and safety department, said the organization recently saw certain types of errors occur repeatedly on the airport or before a takeoff or landing.

To prove airports lack safety requirements, he listed in the order of those requirements: inadequate approach lights, lack of runway marking, lack of friction area, runway surface, obstacles near the runway ends, obstructions, obstructions, obstructions, lack of an approach area of runway, and lack of flight-aid equipment.

• **Pilot Problem**—A local airport or two pilot told the forum that under a special problem.

"Representative cost money," he said, "and these small secondary airports get no federal aid. When considering the needs of secondary fields, you should also try to find lower-cost safety aids."

He also reported that small airports are reluctant to start improvement programs because "helpouts are not around the corner."

All-Weather Flying

On airport facilities for all-weather flight, Col. J. Francis Davis, Jr., director of the Air Navigation Division, said he has increased the rate of handling

traffic in terminal areas more than any other airport.

Bob Taylor, in a prepared statement read by ANDO's Sam Sweet, told the Safety Forum that these problems must be solved in order to get the best out of radar.

- **Altitude**—altitude is not shown on the display scope
- **Identification**—planes are not easily identified with additional aid. After an aircraft has been reported it is difficult to keep identity continuously available to the air traffic controller
- **Noise**—noise appears on the radar scope during storms and some types of precipitation, making it difficult to track airplanes
- **Condition problems**—most between the radar display and step posts are now used in air traffic control centers
- **Tube display**—not big and bright enough for controllers to see in a reasonably high ambient light

Taylor said identity and weather display problems will be reduced and altitude display improved by ANDO's type 3 radar after launch (November), or being used by CAA's Technical Development and Evaluation Center and scheduled for air carrier trials early next year at the New York Washington National area.

This beacon represents what we of ANDO believe to be a true consensus system," said the USAF colonel and "In this time it seems it is completely compatible with the military beacon system."

• **Piloting**—Twelve former pilots showed a lack of confidence for radar because of incidents that they believe indicate CAA intends to use radar in a policing role.

Ernesto Alonzo, Capt. G. M. Shedd and pilot of Pan American World Airways, National Airlines and EAL have had several meetings with CAA representatives in Miami.

"We need it radar to go to be used in a policing aspect, we'd refuse to use it," he reported. "But we just see substantial loss service in CAA, including (Civil Aeronautics Administration) Fuel Fee."

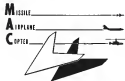
Turboprop Transition

Representatives of Capital Airlines and CAA told ALPA members they believe the transition from piston-engine airplanes to turboprop-powered transports can be accomplished with reasonable ease.

• **Viscous Advantages**—Capt. G. M. Shedd's W. W. Wright, who has started local transport flights on the airline's Vickers Viscount, and he believes the British transport will be simpler to operate, "especially when airports are not in the best state of repair."

He cited these other advantages:

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An "internationalization of the Russian technological advantage" is to be expected since they are getting more young technicians and scientists who have been well educated and trained.

This solemn warning was received by Avionics West in a letter from an internationally known Russian aircraft designer who worked in Russia for more than five post-war years. He now lives in the Western Zone of Germany.

This is the judgment of a man who is technically qualified to evaluate modern aeronautical research and development and who has been working in the midst of the Russian military aviation picture until only a few years ago.

It is a warning that should be carefully studied by the armaments and representatives of the Armed Services and Appropriations Committees as they consider the Fiscal 1956 research and development budget for USAF, Navy and Army aviation.

Unless the United States enlarges its current slim margin of technological superiority over Russian aviation we will be doomed to defeat in another five to ten years. Without the foundation of an adequate research and development program backed by sufficient funds and a sense of national urgency our aerospace technology cannot maintain the pace required for survival in the atomic "Age of Peace."

North American Shares Super Sabre Data

In the constant struggle necessary to protect its legitimate proprietary rights from encroachment by government officials and military brass with a scintillating economic outlook, the aircraft industry is often accused of taking a narrow selfish view of what should be broad problems of national welfare.

The recent policy of North American Aviation, Inc. on the F-100 Super Sabre accident investigation data offers specific evidence to refute this usually groundless charge. North American is a privately-owned corporation operating under the spur of the profit motive in a highly competitive industry. In the course of investigating the F-100 accident that cost the life of its chief test pilot, George Welch, its engineers developed considerable data on the stability and control problems of supersonic aircraft in addition to that furnished by USAF and National Advisory Committee for Aeronautics.

North American made this data available to other

firms with which it is competing for USAF and Navy high speed fighter contracts. A detailed report on the F-100 data was prepared and submitted to other companies on request in copies furnished both USAF and the Navy. The Navy's Bureau of Aeronautics, which has no direct responsibility for the F-100 program although it was investigating similar problems in its own high-speed fighters, was particularly grateful for the North American data and so stated to the company. Internal meetings also were held by North American engineers with Convair and Grumman to provide further details on the F-100 data.

This was a North American policy decision stimulated by its engineering vice president, Ray Rice, and approved by top level management headed by James H. Kandelberg, board chairman, and Lee Atwood, president. In explanation of this policy to Avionics West, a North American spokesman wrote:

"The reasoning back of this action was simply that management felt that if we could save some other company or military test facility from having a fatal accident we should do everything possible to prevent that possibility."

"There is also the very broad thought that it was also of assistance to the defense program is the development of supersonic aircraft."

North American management's decision on this matter has won the admiration of both the military services and their competitors whom it helped on a problem of vital national welfare. It is irrefutable evidence that the aircraft industry can and does place national welfare ahead of personal profit when the occasion demands.

Pacific Wings Club

San Francisco is an area steadily growing in aviation importance. Its magnificent new airport is an international crossroads of the rising airline traffic to Asia and the Pacific islands. Both USAF and Navy aviation have important bases in the Bay area and the highest research laboratory of the National Advisory Committee for Aeronautics is only a few miles down the peninsula.

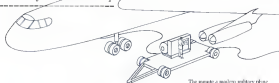
Indication of San Francisco's growth as an aviation center is the establishment of the Pacific Wings Club. This group, now in its second year, aims to provide a focal point and facilities for aviation people in San Francisco and the Pacific islands similar to that afforded by the Wings Club in New York. It now has more than 200 members and club rooms at the Sheraton-Palace Hotel.

John Felipe Turner of the California Aeronautics Commission is now serving as president. Among its members are such leading aviation names as Terry Donahew, president of Western Airlines, Staff de France, head of NACA's Ames Laboratory, and Col. Clarence Young, vice president of Pan American World Airways.

The Pacific Wings Club is off to a good start. It can perform a pleasant and useful function. We wish it well.

—Robert B. Holz

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precise power before take-off



The minute a modern military plane leaves the ground, electric power must about takes over. For control, navigation, radar, even cooling... all are electrical. And every system must be right before take-off.

This precise power package... latest product of Leach Inter-corporate teamwork... brings new accuracy to engine ground service. Its 600-cycle power, regulated to accurately narrow limits, more than matches the precision of the airborne units being checked out. It helps make modern flight... and fight... practical.

Leach Corporation is naturally well equipped to deliver such specialized projects. Its controlled responsibility means you of products... other components or complete systems... consistently top both in efficiency and dollar value.

This new INET power package reliably competently designed defect free machines, Leach ships, INET electronic controls and Palmer rotating machinery.

LEACH

CORPORATION / INET PRECISE POWER DIVISION

400 SOUTH SANTA FE AVENUE 104 ANGELES 31 CALIFORNIA

LEACH RELAY DIVISION
PALMER GENERATOR DIVISION
INET PRECISE POWER DIVISION
JAMES TRANSDUCER DIVISION

SAFETY PRODUCT IN THE LABORATORY IN THE PLANT ON THE GROUND IN THE AIR

DISTRICT OFFICES AND REPRESENTATIVES IN MAJOR CITIES OF U.S. AND CANADA

Every

B-47 "STRATOJET"

Uses this Amplifier and Power Supply Rack...another
Servomechanisms'
"building block" system



This sub-system is another outstanding example of Servomechanisms' packaged function philosophy.

Consider the seven SA104H Servo Amplifiers used in this system. Servomechanisms has designed and produced over 40,000 of these amplifiers. All are 100% electrically and mechanically interchangeable. They are a USAF standard — designated Type A-1 — and as such are "shelf items" in supply depots throughout the world.

As a USAF standard, these amplifiers are used in many other systems in almost every modern fighter aircraft.

This demonstrates how Servomechanisms' packaged electronic functions have helped standardize and simplify fire control equipment—and why designers and users of control equipment specify Servomechanisms, Inc., for economy and reliability.

The reliability of Servomechanisms' equipment is directly traceable to the ease of maintenance inherent in the "building block" philosophy.

SERVOMECHANISMS
INC.
PACKAGED FUNCTIONAL COMPONENTS